RADIO & ELECTRICAL Review

INCORPORATING "RADIO AND ELECTRONICS"

PUBLISHED MONTHLY IN THE INTERESTS OF THE N.Z. ELECTRONICS INDUSTRY

Price - - 2/3

VOLUME 18 NUMBER 11

JANUARY 1, 1964

In This Issue . . .

TV · AUDIO · SERVICE · AMATEUR RADIO

Letters from Readers

Sir,
I heard recently that you have in the past published details of a television receiver built around a 5″ cathode ray tube and I would be very pleased if you could send me the back-number containing that circuit, or failing that, the details of any other home-built television set. Please find enclosed cheque for 4/-.

Yours faithfully,
J. M. HENDERSON,
Marton.

We regret that the back issue is not available. We intend publishing such a set using modern components, etc., in our March or at the latest April issue and hope that this will be suitable for you.—Ed.

—★—

Sir,
No doubt Ian Hunter is a dab at building a soap-box transistor (December issue) but his arithmetic is not nearly as good as his radio set.

My abacus adds up to some £3/5/-. Is there an error in the cost of parts shown — that is possible if they could be purchased second-hand or war asset, but otherwise those shown seem about right.

Please, I hope this is not an example of the "play-way" at schools nowadays — all soldering and no sums!

Could we have in 1964, some constructional details on simple transistor portables and a transistor car radio?

Yours faithfully,
WINSTON LEWIS,
Parnell.

Thanks for your entertaining comments — we will try to meet the last paragraph request.—Ed.

—★—

Sir,
I have read the most interesting article on Loudspeaker Systems, by L. O. Hunter, in the December issue, but most cross swords with the author regarding the statement that it is usual for smaller speakers to be more efficient as I have always been under the impression that the reverse was true. Admittedly, it is difficult to obtain figures for speaker efficiency, most manufacturers being decidedly reticent on this point when listing specifications.

However, I have found one manufacturer who has published this information and I believe it bears out my contention. The efficiency figures quoted range from 1% for a 2″ model to 14% for a 12″ model. In order to have a basis for comparison, it is necessary to have magnet systems of equal efficiency and this obviously cannot be done in the case of the two extremes mentioned above. There are two models listed having the same magnet assemblies but with different diameter cones which are as follows: **Size:** 5″, Flux Density Gauss: 8,500, Total Flux Maxwells: 15,800, Efficiency: 1·8%, Power Handling Capacity: 3 watts; **Size:** 8″, Flux Density Gauss: 8,500, Total Flux Maxwells: 15,800, Efficiency: 3%, Power Handling Capacity: 6 watts.

From this it is seen that for a given magnet system an increase in cone size will result both in increased efficiency and power handling capacity.

For a comparison between speakers of similar cone areas but different magnet sizes the following:

8″:	8,500	15,800	3%
8″:	11,000	26,000	6%

Here again the larger the magnet the greater the efficiency and power handling capability.

Whilst not doubting the need for attenuators on the high and mid range speakers I believe the author is in error in ascribing this need to the higher efficiency of these speakers as compared with the woofer unit. I suggest it is due rather to the response curve of the human ear, and this is borne out by noticing the differences in "power output" of the various instruments of an orchestra.

Two further points — I know of no commercially available 15″ or 18″ bass speaker with a cone resonance of **less** than 35 cps as stipulated and also know of no 12″ speakers with 5Ω voice coils as suggested alternatives, or tweeters with 5Ω to 10Ω voice coils. In all cases the standard commercial impedances are 3Ω or 15Ω (measured at 400 cps).

Could we have Mr Hunter's comments please?

Yours faithfully,
J. W. STOKES,
Auckland.

Mr Hunter replies . . .

Sir,
Your correspondent raises an interesting point with regard to speaker efficiency. It is a matter of experience that good quality tweeters sound louder than large speakers **operated as tweeters.** There is no doubt about the higher efficiency of horn loaded tweeters as they require considerable attention before sounding in balance with a cone speaker. I do not think the performance of the human ear affects the problem.

I do not agree that speaker efficiency increases with diameter unless the performance is averaged over the audio spectrum. Since the acoustic output falls at 6 db/octave below a frequency where the wavelength equals the cone circumference, small speakers would show low efficiencies measured this way.

Probably one reason why tweeters need attenuating is they are matched to the amplifier output. A large speaker of 15 ohms at 400 c/s is probably nearer 40 ohms at 3 Kc/s, whereas a tweeter is 15 ohms at this frequency. When operated on a constant voltage output (the rule today with negative feedback amplifiers), the large speaker would thus produce less output than the correctly matched tweeter even if both were of identical efficiency at, say, 3 Kc/s.

Stronger magnets increase efficiency by reducing the voice coil ampere turns required for a certain output. The impedance is increased and, for the same volt/ampere input, less current flows and less power (I^2R) is lost in the voice coil.

It is true that there is a very limited choice of voice coil impedances in large speakers. If 2 - 15 ohm speakers are used in parallel or two or three units of 3 ohms used in series, the easiest way to match them is to bring a 6-8 ohm output from the amplifier in addition to the standard 15 ohm. The crossover elements should be halved in reactance, i.e. the capacitance doubled and the inductance halved.

It is also true that low cone resonance speakers are hard to obtain. A little surgery in replacing most of the cone edge corrugations with limp cloth or plastic is the answer.

May I take this opportunity to clarify two points in the article. The middle and treble speakers are mounted in a sealed box which is filled with sound-absorbing material, graded from front to back, soft to firm, i.e. cotton wool close behind the speakers and then wool flock or else wedges at stated.

Finally, the half section network attenuates at 12 db/octave not 6 as stated.

Yours sincerely,
L. O. HUNTER.

N.B.

We would like to draw the attention of our Auckland readers to an announcement on page 35 of this issue.

BACK NUMBERS OF "R. & E."

Periodically inquiries are received for back numbers of "Radio and Electrical." A few copies of the issues since the publication changed hands (i.e. April 1961), are available from the publishers: The Magazine Press Ltd., Lumley House, 10 High Street., Auckland. (P.O. Box 1365).

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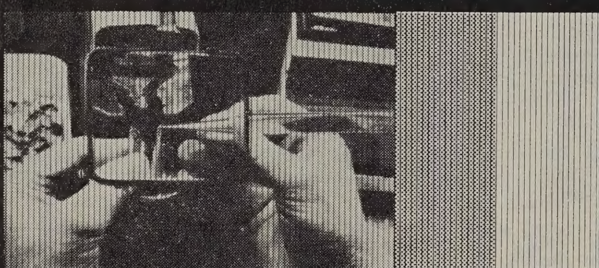

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E180F(6688)	3	190	13	50	16.5
E186F(7737)	3	190	13	53	16.5
E810F(7788)	5	135	35	57	50
E130L(7534)	27.5	250	100	6.5	25
E55L	10	140	50	30	45

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Radio and Electrical Review

OFFICIAL JOURNAL OF

The New Zealand Electronics Institute (Inc.)

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RADIO AND ELECTRICAL REVIEW

(Established 1946)

Published Monthly by the Proprietors:

THE MAGAZINE PRESS LTD.,

Publishers also of

HOME AND BUILDING

Director and Chairman:
Victor L. Beckett

Director and Secretary:
Wilma W. Beckett

Production Manager:
Robin H. E. Beckett, B.A.

at the Registered office of the company: Lumley House, 10 High Street, Auckland, C.1., N.Z. P.O. Box 1365, Auckland. Telephone 41-508.

* * *

Sole New Zealand Distributors:
GORDON & GOTCH (N.Z.) LTD.

From Newsagents — 2/3 per copy. Or direct from the publishers 27/- per year in advance, post free throughout the world.

* * *

Advertising Representatives for the United Kingdom:
PUBLISHING & DISTRIBUTING CO., LTD.,
177 Regent St., London, W.1.

* * *

Printed by Farrell Printing Ltd., Mt. Roskill, Auckland. Registered as a newspaper at the G.P.O., Wellington.

Vol. 18, No. 11 January 1, 1964

Contents:

On Our Cover

INSTRUMENTATION BY AWA

The new basic knowledge resulting from today's research can profoundly alter the direction and broaden the scope of electronic science. Within the laboratories of the electronics industry today, scientists are discovering new and better ways of controlling and employing electrons that move from one atom to another within a tiny piece of material, and even electrons that remain localised within a single atom.

Digging deeply into this sub-atomic world is only possible with the aid of accurate and complex tools of research. Moreover, proper instrumentation is essential to every service department and design laboratory. It is natural therefore that AWA should manufacture a variety of scientific and measuring instruments. AWA is also associated with other leading overseas instrument manufacturers.

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Featured Next Month

☆ Looking At Crystals — continued

☆ Radio-Wave Propagation and the Planning of V.H.F. and U.H.F. Sound and Television Services

☆ An Impedance Bridge

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PT	**3**	260/260 V	60 Ma.	6.3 V	2 Amp.		
PT	**4**	280/280 V	60 Ma.	6.3 V	2 Amp.	5 V 2 Amp.	
PT	**5**	350/350 V	60 Ma.	6.3 V	2 Amp.	5 V 2 Amp.	
PT	**6**	115/115 V	65 Ma.	6.3 V	1 Amp.		
PT	**7**	115/V ½ Wave	65 Ma.				
PT	**8**	280/280 V	80 Ma.	6.3 V	3 Amp.	5 V 2 Amp.	
PT	**9**	310/310 V	80 Ma.	6.3 V	3 Amp.	5 V 2 Amp.	
PT	**10**	350/350 V	80 Ma.	6.3 V	3 Amp.	5 V 2 Amp.	
PT	**11**	310/310 V	100 Ma.	6.3 V	4 Amp.	5 V 2 Amp.	
PT	**12**	350/350 V	100 Ma.	6.3 V	4 Amp.	5 V 2 Amp.	
PT	**13**	310/310 V	125 Ma.	6.3 V	4 Amp.	5 V 3 Amp.	
PT	**14**	310/310 V	150 Ma.	6.3 V	5 Amp.	5 V 3 Amp.	
PT	**15**	400/400 V	150 Ma.	6.3 VCT	5 Amp.	5 V 3 Amp.	
PT	**16**	400/400 V	150 Ma.	6.3 VCT	2 Amp.	5 V 3 Amp.	6.3 V 4 Amp.
PT	**17**	450/450 V	150 Ma.	6.3 VCT	2 Amp.	5 V 3 Amp.	6.3 V 4 Amp.
PT	**18**	450/450 V	200 Ma.	6.3 VCT	2 Amp.	5 V 3 Amp.	6.3 V 4 Amp.
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		Used in TV Receiver with Mains Rectification.					
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PT	**27**	280/280 V	125 Ma.	6.3 V	5 Amp.	CT 6.3 V 1 A.	
PT	**28**	280/280 V	175 Ma.	6.3 V	4 Amp.	CT 6.3 V 4 A.	CT 5 V 3 A.
PT	**30**	104 V	150 Ma.	6.3 V	5 Amp.	CT	
PT	**31**	126 V	125 Ma.	6.3 V	3 Amp.	CT 6.3 V 3 A.	

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ELECTRONICS IN WESTERN COUNTRIES

A recent article* by Th. P. Tromp, Vice-President, N. V. Philips Gloeilampenfabrieken, outlined some interesting facts and figures on the role of electronics in the economies of Western countries. In this article, entitled ''Electronics Today and in the Future'' the author considers the speed with which one discovery follows another and in so doing the remarkably short period involved before a recent development becomes widely accepted and incorporated in general production procedure.

''After the basic development of the new magnetic materials and semi-conductors, only about three years were needed to put them into production and practical application. At the present time new inventions, the result of continuously expanding and deepening scientific research, are following in such rapid succession that economic developments scarcely seem able to keep pace with the breathtaking advance of science and technology.''

To date, the United States has plainly held a lead over Western Europe in the applications of electronics, while at the same time the former's efficiency (reckoned on production per head) is greater. However, the working population of Western Europe is 70% larger than in the U.S.A. This would appear to point out the direction in which Europe should move. The figures advanced seem to support the idea of marked expansion in Western Europe narrowing this gap.

After acknowledging the basis of this progress in electronics to be research, the author of the article goes on to consider the support given to research. ''In the countries of Western Europe, expenditure on research, as far as the industries themselves are concerned, claims a share in the order of 5 to 6% of their total turnover. This percentage takes no account of projects directly or indirectly financed by Government . . . But if we again compare the relevant European and American figures, we see that in the U.S.A. the Government sponsors an over-riding research programme corresponding to roughly 10% of the turnover of the electronics industry, while the research investment of industry itself is of the same order of magnitude as in Europe. This plainly indicates the enormous support which American industry receives from the Government.''

Despite America's lead in the fields of research and of output, Western Europe appears to be making up lost ground with greater annual investment in fixed assets. Such capital formation is a valuable step towards increases in output and research.

The future role of electronics is revealed by the changing emphasis among the branches of the industry. In Western Europe the growth of turnover in the components sectors, especially the ''professional'' field, is much greater than the increase in the entertainment sector and the former is expected to take over the lead. Very significant growth is taking place in the field of computors and industrial electronics. In the United Staes professional electronics and components already have a greater turnover than the entertainment sector. In addition, Government contracts are exceptionally large.

Certain contributory aspects of the gap between Western Europe and the United States have been seen and yet there seems every possibility of this narrowing in the future.

At this juncture, Mr Tromp outlined some probable developments, seemingly very advanced, only to come to the conclusion that ''yet — we are still only at the threshold.''

Fields exist in all branches of life for limitless expansion and development. Miniaturisation, microminiaturisation and solid state circuits, inexhaustible data processing capacity and control applications; medical advances and communication developments present the possibility of a rapidly changing world.

To this changing world, New Zealand must adjust or else our life must exist as an anachronism. The adjustment must be of our own making because other nations are too busy to concern themselves about us.

Whilst not intending, at this stage, to review New Zealand's role, a few thoughts occur in passing. A theme often emphasised in this journal is the need for more and better technician training and for refresher courses and continued application after the initial period of study is completed. This is essential to maintain our ability to make use of developments from overseas. Scope exists for research into problems peculiar to our country and the industries on which its economy is based. We should be capable of undertaking development work to advance our own economy and solve its particular problems.

Some local firms have demonstrated another important feature. There are markets to be found, especially in the East, for specialised equipment based on limited production. In this field the economies of large scale production seldom exist and hence New Zealand can compete much more successfully in the export field than normally.

* Published in the *Financial Times,* 14.12.63.

RADIO EQUIPMENT OF YESTERYEAR

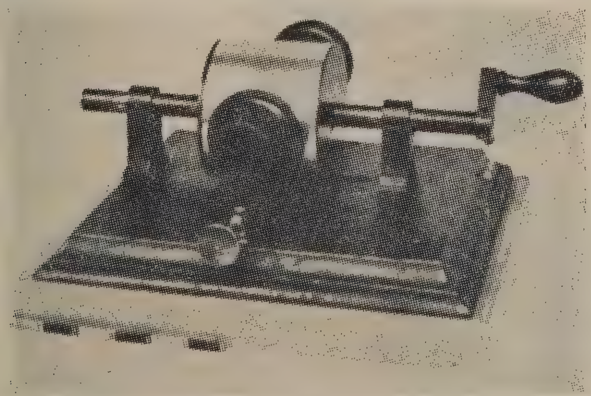
by B. S. JONES

A visitor to Britain interested in the story of the origin and development of the radio art cannot do better, we feel, than spend some time in the radio section of the Science Museum at South Kensington in the City of London. The writer, who has spent over 50 years in the radio game, in the course of a short visit to Britain recently, managed to spend — in instalments — a total period of about 10 days at this establishment and was enthralled at the evidence housed therein of the enormous province of scientific knowledge that man has already won in the field of radio communications. Just to stand, examine and reflect on, for instance, an exact replica of the gear used by Hertz in 1885 or the actual apparatus used by Marconi in 1898/99, or, coming nearer to our day, the original television apparatus used by Baird in 1926, is indeed something to wonder and marvel at !

It is proposed in this article to give a brief account of some of the principal exhibits as they are presented — in chronological order of development — to the visitor to this museum. Housed in glass cabinets, each exhibit is adequately labelled with its purpose, maker and year of manufacture clearly indicated. One can take notes without let or hinderance and "it is all on the house" since there is no admission or other fees whatsoever. Altogether a "must" and a "Mecca" for all "dyed-in-the-wool" radio enthusiasts visiting the great Metropolis !

Exhibit No. 1

This is a portrait of James Clark Maxwell (1831-1879). Elected Professor of Natural Philosophy at King's College, London in 1860, Clark Maxwell became keenly interested in the propagation of light. His researches led him to develop his electro-magnetic theory of light and he showed mathematically that light consists of waves or vibrations which have a frequency of about 600 million m/metres a second and travel at a velocity of approximatedly 186,000 miles per second. He also proved mathematically that electro-magnetic waves of other frequencies must exist if only the means could be found to generate and detect them. It was more than 20 years later before the practical demonstration of the existence of these waves was made by Hertz.



An original Edison Phonograph (1877)
(Science Museum Photo)

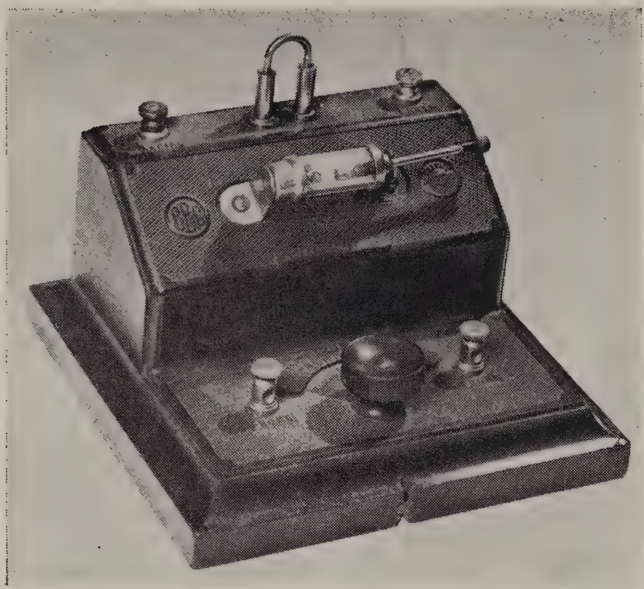
Exhibit No. 2 — Hughes' Microphone Detector

This is a portion of the apparatus made and used by David E. Hughes, a Welsh Professor of Physics at the London University in the experiments which led him from the invention of the microphone in 1878 to the transmission and reception of wireless signals over short distances in 1879. In the course of experiments with his induction balance he found that if a circuit was formed by joining up in series a battery, a microphone and one of the coils in his balance, any interruption of the circuit was accompanied by a disturbance which became audible in a 'phone receiver connected to another microphone even when the two circuits were widely separated and there was no direct connection between them. Hughes carried out a great many experiments, many of which were witnessed by eminent men of science, but whereas Hughes was convinced that they were due to conduction between the two circuits, his friends eventually came to the conclusion that they could all be accounted for by the known laws of electromagnetic induction; it is now certain that in these experiments, Hughes was dealing with true Hertzian waves such as are now used in radio and that he was unwittingly employing in their detection, the coherer method of reception which was first used for this purpose by Sir Oliver Lodge in 1889.

The original microphone detector shown here consists of a steel needles hanging in light contact with a small circular hole in a block of carbon.

Exhibit No. 3

As has already been mentioned, the possibility of electro-magnetic wave propagation through the ether was predicted — from purely mathematical investigations — by Clark Maxwell in 1864. Heinrich Hertz (1857 - 1894) provided the practical proof of this between 1887 and 1890 in a series of brilliant researches. His object was to demonstrate, not only the existence of such waves but also their physical identity with ordinary light waves in that they could be reflected, refracted, polarised etc., and that they would give nodal points which refracted whereby their wavelength could be measured. These experiments were undertaken purely for their physical significance, but they laid the foundation of what we now call radio communication. This exhibit contains an autographed photograph of



Brownie Crystal Set

Hertz and also one of his original manuscripts — in his own handwriting — dated 1888 to the Berlin Academy of Science. In it he describes their propagation, polarisation, reflection and refraction. By experiments described in this paper Hertz confirmed the identity of electro-magnetic waves with waves of light and radiant heat.

Exhibit No. 4 — Hertz Large, Open Oscillator (1886-1887) Replica

Hertz's original oscillator comprised a thick copper wire 2·6 metres in length, at mid-point of which a small spark-gap was inserted and connected to an induction coil. Two zinc spheres of 30 cms. diameter were fitted to the wire and by adjusting their position on the wire the electrical length of the circuit could be varied.

By the use of a receiving circuit of a square loop of wire having sides a 75 cms., one of which contained a micrometric spark-gap, Hertz was able to demonstrate the existence of resonance phenomena and he calculated that the frequency of oscillation as being of the order of 60 mc/s.

Exhibit No. 5 — Hertz Resonator (Replica)

Hertz preferred visual observation of sparks induced in his resonator. The sparks rarely exceeded 2 m.m. in length and in order to perceive them he trained a visual magnifier in close proximity to the spark-gap. In order to obtain good results he found it necessary to remain in a darkened room for some time before starting experiments. Sometimes the resonator was provided with a screw-micrometer adjustment for the spark-gap the strength of oscillations being established by the length of the spark observed. Care was taken that the natural frequency of the resonator co-incided with that of the oscillator in use.

Exhibit No. 6 — Hot-wire Galvanometer used by Hertz in 1883 (Replica)

Although in most of his experiments on electromagnetic radiation, Hertz utilised a micrometer spark-gap to detect oscillations in his receiving resonator, he occasionally made use of instruments. The inductance of coil-wound galvanometers made them unsuitable for H.F. measurements, so Hertz designed a special hot-wire instrument.

Exhibit No. 7 — Rotating Mirror Apparatus (Hertz, 1887) Replica

The predictions of Lord Kelvin and von Helmholtz that the discharge of a condenser may take place by a series of electrical oscillations or alternating and decaying discharges were first proved experimentally in 1858 by Peddersen. Peddersen examined the spark of a Leyden jar by the aid of a rapidly revolving mirror and noted that the image of the spark was not always drawn out into an uniform band of light, but that when the resistance of the discharge circuit was low, was seen to be composed of a number of separate images, thus proving the existence of separate discharges or oscillations. The experiments of Peddersen were repeated by Hertz at the commencement of his own researches.

Exhibit No. 8 — S.W. Oscillator and Parabolic Reflector (Hertz, 1888) Replica

In his early experiments Hertz used waves of the order of 5 metres and detected the oscillations by observing the tiny sparks jumping the gap in a resonant loop of wire, the range being only 2 to 3 feet. In order to make waves detectable at a greater distance, Hertz used much shorter wavelengths and concentrated them into a beam with the aid of a parabolic reflector. The oscillator consisted of two brass tubes, 3 cms in diameter separated by a spark gap and positioned so as to have an overall length of about 26 cms. Hertz found that this arrangement produced oscillations with a wave-length of about 60 cms. Using a reflector 2 metres in height, waves were concentrated into a beam and Hertz was able to detect them at a distance of 15 to 20 feet.

Exhibit No. 9 — Hertz Oscillator and Resonator (1888) Replica

With these Hertz established the finite velocity of the propagation of electro-magnetic action. The oscillator consisted of two square brass plates (2′ x 2′ approximately) separated by a spark gap and excited by a powerful induction coil. Oscillations of a frequency of about 50,000 Kc/s were generated in a wire coupled electrostatically to one plate of the oscillator.

Exhibit No. 10 — Lodge Spherical Oscillator (1894) Original

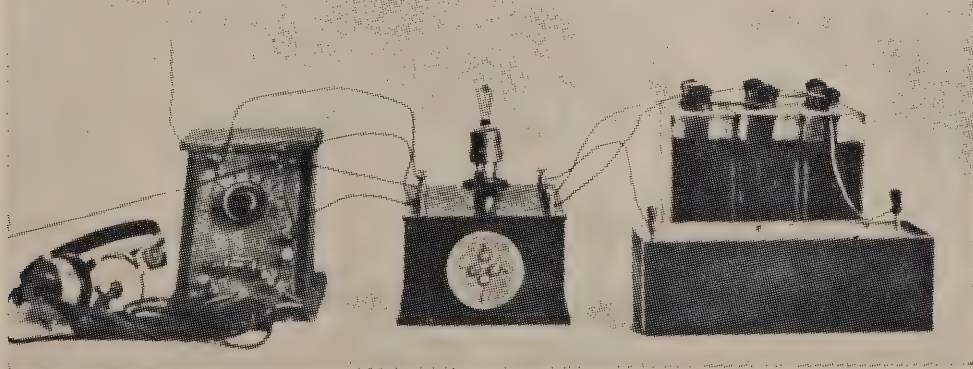
Sir Oliver Lodge used this in 1894 when wireless signals were sent and detected by his "spring" coherer" at a distanee of some 20 yards through walls. The sphere when excited gave sparks at the ends to two small brass knobs and emitted waves 7 inches in length. Radiation was very powerful, but owing to high damping, the oscillator was enclosed in a copper screening device with a variable aperture in order to prolong the duration of the waves and project them in any desired direction.

Exhibit No. 11 — A Hertz type Oscillator and Resonator actually used by Lodge in 1895. Detectors (1). Coherers

The Hertzian resonator depending on the observation of the very minute sparks was a very insensitive device. The coherer offered a large resistance to the passage of a current until a signal was received when the resistance suddenly dropped

(Please turn to page 36)

A receiving set, with a two-stage transformer coupled H.F. amplifier in a set built on the Unit Principle.



A hand-made transformer coupled H.F. Amplifier connected to a receiving set.

High-Tension Rectifiers for High Power Transmitters

by B. E. FOX, B.Sc., A.M.I.E.E.

Until recently, experience with silicon diode rectifiers was not sufficiently extensive to justify their use in high-power communication transmitters. Their many advantages, not least their great life, make them attractive. The article compares the advantages and disadvantages of possible types of rectifiers which may be used for this service. It concludes that, despite the fact that their low voltage rating means that many have to be used in series, there is solid advantage in using silicon diode rectifiers in this application.

Introduction

The overall cost of equipment to a user is governed by the cost of operation, maintenance and outage time, as well as first cost. Of these, the maintenance and outage time depend upon the reliability of the equipment.

Reliable operation means use of an equipment within the designed limits of performance without breakdown. This permits continuity of programme or service, low maintenance costs, and the possibility of unattended operation.

This article discusses the rectifiers which provide high tension supplies in high power transmitters. The conclusion is reached that silicon diodes may be used in rectifier assemblies and that they offer an improvement in reliability in comparison with other types of rectifiers, at reduced overall cost.

Types of Rectifiers

Since semi-conductor rectifiers are mainly low voltage devices with current ratings up to 200A, these have been successfully applied in industrial plants, using parallel connections to achieve outputs of thousands of amperes. In such plants, the high powers involved are of the order of megawatts. Consequently, small differences in conversion efficiency correspond to thousands of pounds annually in running costs. As well as high conversion efficiency, the advantages of monocrystalline (silicon and germanium) rectifiers compared to copper oxide, selenium, mercury arc and mechanical rectifiers, for use in low voltage high current supplies, are small size, reduced weight, and inherent reliability. The choice between silicon and germanium is one requiring minute appraisal for this type of application.

In the majority of radio transmitters, DC requirements rarely exceed 200A for the filaments of high power transmitting valves (in those cases where DC filament lighting is necessary).

For the high tension supplies, relatively high voltages at relatively low currents are required.

(The Marconi Company Limited, Chelmsford, England)

Voltages for transmitter supplies range up to 10 kV, and in some cases up to 20 kV. Until recently valve or mercury arc rectifiers were the only types that were suitable for the high tension supplies in other than low power transmitters. The recent intensive development of monocrystalline semiconductor rectifiers, primarily for electrochemical and electric traction requirements, has made them suitable for consideration for this type of application, even though the natural advantages of the devices are not fully exploited. The table summarises the characteristics of the alternatives available.

Choice of Rectifier for Modern Communication Transmitters

Transmitters are essentially power converters. The keystone of this conversion is the existence of the various positive and negative DC supplies for the anodes, screen grids and control grids of valves, together with those for control circuits. The transmitter type and the circuits used determine the regulation required to give adequate performance.

The regulation of a main HT supply should be good enough to meet the distortion or linearity requirements of the circuit. With the trend towards improved distortion specifications, the regulation requirement becomes more stringent.

Regulation requirements exclude the use of high vacuum rectifiers for the type of main HT supply used in high power transmitters. If, however, the requirement was for a constant load such as that for an FM transmitter or a transmitter using a high power klystron, the use of high vacuum rectifiers would be permissable (since the regulation would not be a decisive factor).

To a lesser extent, selenium rectifiers also tend to be excluded where good regulation is required. For the lower voltage supplies, however, the regulation requirements may permit the use of selenium cells. It is then necessary to improve the operating life above the figures quoted, reduce the ageing and accept the size and weight penalties

of this type of rectifier. Bad regulation can also be associated with high heat dissipation. This heat has to be extracted from the equipment. There is thus a capital cost in providing or augmenting the method of heat extraction as well as the running cost in producing loss power.

There are thus three practical alternatives — Xenon, single anode mercury arc and silicon rectifiers — where good regulation of an HT supply is essential for the satisfactory working of the transmitter.

Apart from the question of regulation, one must also consider the other characteristics in relation to the listed rectifier types.

The life expectancy of one type of Xenon valve at full voltage rating is about 10,000 hours, whilst that of another is about 5000 hours. The latter figure can be doubled by working at half the voltage rating. There is also a recent indication that an improvement can be produced by restricting the ambient temperature to the moderate value of 35°C. This, however, is not feasible for tropical installations. The loss of the gas with increasing age in these types of valves produces an increase in forward volt drop, so that the output voltage of the rectifier circuit is reduced. Eventually the valve will cease to conduct. In these circumstances, apart from the reduction in output voltage, the output ripple is increased, whilst the transformer can overheat and the smoothing components suffer distress. The finite rectifier life will contribute to the running cost of the transmitter. In a fifteen-year equipment life, when using rectifier valves, it is to be expected that replacements will be 10 sets of valves (on a basis of 10,000 - hour life per valve).

In a valve system, any tendency to arc-back is a disadvantage. Arc-back reduces the valve life and usually will be followed by blown fuses, resulting in interruptions of service. Arc-back can be caused by excessive voltage across a valve (produced, for example, by lightning strikes). However, the risk of arc-back in Xenon rectifiers can be reduced by fitting suppression networks to the rectifier transformer.

The single anode mercury arc tubes referred to in the table are Excitrons. These have dipper excitation and are fitted with a control grid. A number of high-power communications transmitters use this type of rectifier. At one large station, the operating lives of these tubes have averaged 20,000 hours (varying between 13,000 to 27,000 hours). Excitrons are versatile and give a number of operational advantages. The grid control enables a low voltage, low power control circuit to handle high powers. For example, the useful facility of

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ABOUT THE AUTHOR

B. E. FOX. Born in South Wales in 1920. Graduated from University College of Wales, Swansea, in 1948, his university career having been interrupted by war service. Joined Marconi's in 1948, starting in Advanced Development Group, and was working on the basic development of channellized transmitters. Transferred to Transmitter Development Group in 1949 and took part in the original work leading up to the world-famous HS series of transmitters. From 1958 he has specialised in power supplies and control systems, with particular emphasis on semi-conductor rectifiers.

GENERALIZED COMPARISON OF RECTIFIER TYPES USED IN HIGH POWER TRANSMITTERS

Characteristic	High Vacuum Valves	Xenon Valves	Single Anode Mercury Arc	Selenium Cell	Silicon Diode
REGULATION	poor	good	good	fair	good
DISSIPATION	high	low	low	medium	least
OPERATING LIFE (HOURS)	2000 – 6000	5000 – 10,000	5000 – 20,000	4000 – 10,000	unlimited
SHELF LIFE	good	fair – good	fair	fair – good	unlimited
CHANGE OF RECTIFIER CHARACTERISTICS WITH AGE	negligible	gas clean-up; increase in forward drop and losses	slight	steady increase in forward drop and losses	none
TENDENCY TO ARC BACK	no, except at end of life	yes	yes	no	no
FILAMENT TRANSFORMERS REQUIRED	yes	yes	no	no	no
START TIME	1 sec.	10 sec to 5 min.	nil	nil	nil
OPERATING TEMPERATURE LIMIT	200°C (bulb temperature limit)	70°C	40°C	55°C	140°C
WORKING VOLTAGE LIMIT	40,000 V	13,000 V	17,000 V	36 V per cell*	600 – 1500 V*
TRANSIENT VOLTAGE RATING	good	limited	limited	good	poor
CURRENT OVERLOAD RATING	good	fair – good	excellent	fair – good	poor
SIZE	medium	medium	medium	large	small
WEIGHT	medium	medium	medium	heavy	light

* Can be used in series for higher voltages.

one-third and two-thirds full voltage for tuning and testing can be obtained by grid control. In addition, Excitrons meet the requirements for good regulation, and do not usually involve additional starting delays. The main limitation is one of temperature; the temperature limits of 5°C to 40°C necessitate heaters for lower ambient temperatures and refrigerated air for use at higher temperatures. This delays transmitter run-up time.

For the high voltage requirements of communication transmitters, selenium rectifiers are large and heavy compared with the other types in the table. Unless a compromise can be accepted, their regulation is also unsatisfactory. The variation of their characteristics with temperature leads to the use of more bulky units for higher temperature operation. Certain types can operate up to 85°C but their ageing is unsatisfactory. To improve the life, selenium rectifiers have to be operated at reduced ratings which further increase the size of the rectifier assembly. Improved types of selenium rectifiers are claimed to have a better performance and are smaller than those previously used. It is hoped that the life expectancy of 50,000 hours is a valid claim.

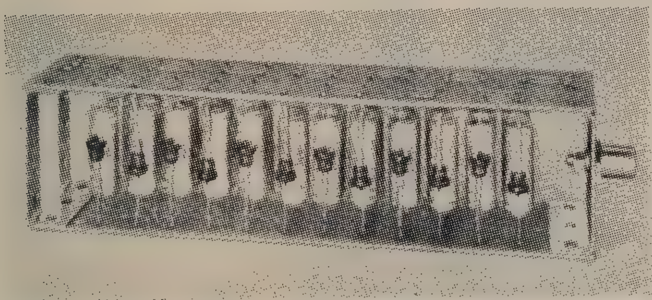
So far, hot cathode mercury vapour rectifiers have received no consideration. This is because of their temperature limitations and excessive warm-up time. It is desirable to take no more than two minutes from first switching on to attaining full RF output, and this is difficult to obtain for equipments using this type of valve. Work is at present proceeding on rectifiers employing mixtures of mercury vapour and the rare gases. The object is to combine the life advantages of the mercury vapour type with the temperature advantages of, for example, Xenon gas. The results are, as yet, not decisive.

Silicon Diode Rectifiers

The preceding generalised survey of the merits and demerits of the four main types of rectifier generally used has shown that no one type is ideal. A study of the table indicates that, with the exception of two characteristics, silicon diodes offer a much improved performance. These two characteristics are poor current overload rating and poor transient voltage rating. In order to assess the possible use of silicon diodes, it is necessary to discuss these apparent demerits and show how, by reliable engineering, any difficulties may be overcome.

The better the regulation that is required for a particular application, the higher is the fault current that the rectifiers have to withstand in the event of a short-circuit. The rectifiers have to withstand this condition successfully for the time that the transmitter protective system takes to open the circuit safely. The circuit must then be capable of normal service. The number of fault operations that the system can successfully handle must be consistent with the life expectancy of the equip-

ment. Where a silicon rectifier is to be used, the type has to be chosen on its overload surge rating and not on its mean current rating. The overload surge rating curve to be used will depend upon the rectifier junction temperature and its variations with normal and overload duty. The junction temperature will have two contributions, that due to the ambient temperature, and that produced by the loss or dissipation within the rectifier.



Typical Silicon Rectifier string designed to give a complete assembly with natural convection cooling.

Design based on overload considerations may involve choosing a rectifier capable of a mean current of, for example, three to five times that required for normal service. Consider, for example, a transmitter which has a requirement of 7500 V at 1·5 A. This equipment uses a three-phase bridge-connected rectifier assembly. The peak fault current, through one leg of the bridge, should a short-circuit occur between the rectifier output and the smoothing inductor, is 30 A. The mean current through one leg of the bridge is approximately 0·5 A on steady-state full load. To cater for the short-circuit condition, a diode rated at 1·5 A mean current is used. For static equipment, it will be sufficient to design on a rectifier ambient temperature of 65°C. where the equipment ambient temperature is 45°C. (Of course, this general philosophy of correlating the fault current of the circuit to that of the rectifier must be applied to all types of rectifier. However, for most of the alternatives, the fault current limitation is not so severe as with silicon diodes).

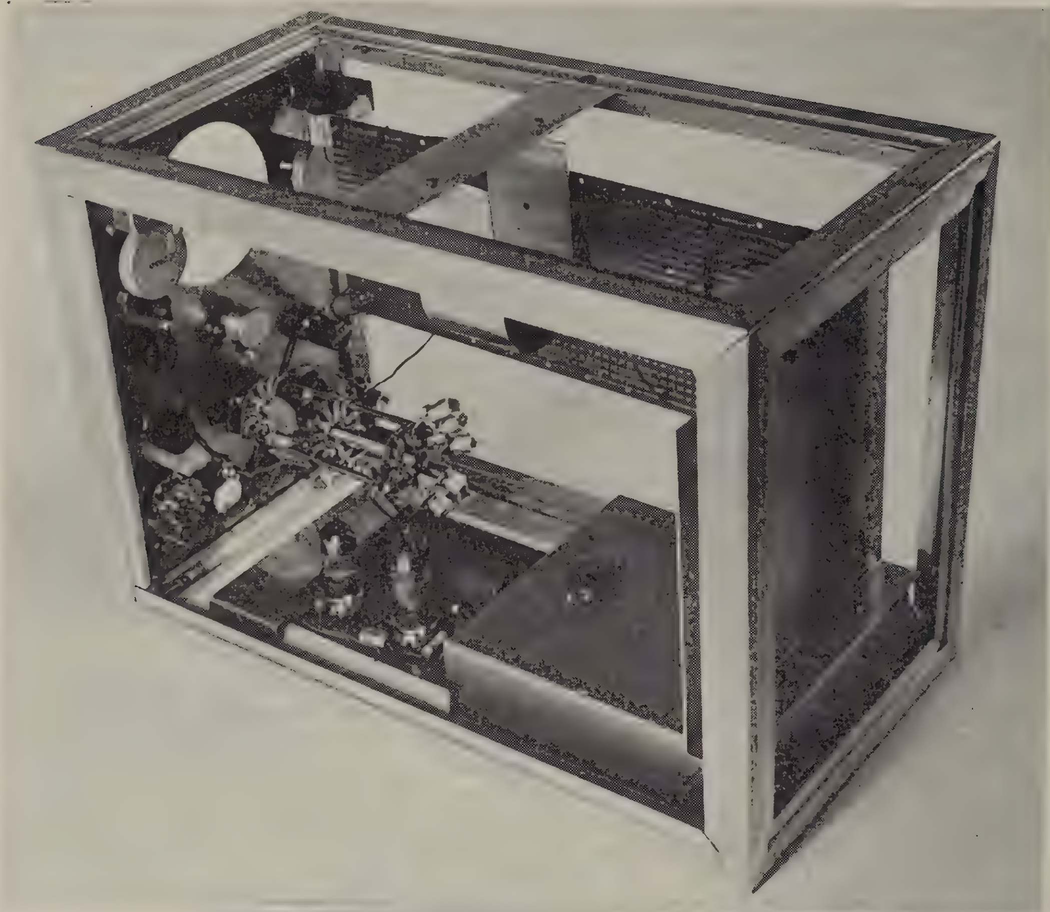
In the table the transient voltage rating of silicon rectifiers is quoted as poor. This expresses the fact that silicon diodes can be destroyed by over-voltages of sufficient magnitude. Such over-voltages would not, in general, destroy the other types of rectifiers quoted in the table and protection by derating must again be provided. The transient voltage rating is therefore of primary importance. The maximum surge voltage permitted on the circuit has to be established, and the voltage rating of the rectifiers chosen to be greater than this figure. To meet such a requirement, the voltage rating of the diodes must be two, three or more times that required for normal operation, despite the incorporation of transient suppressors, such as resistance-capacitor networks. For the greater part of their lives, therefore, silicon diode rectifiers are subject to voltages which are a fraction of their rating.

For supplies where the voltage required is in excess of that of the individual diode rating, diodes are arranged in series. To provide an even distribution of voltage across the diodes under all working conditions, a capacitor and resistor are connected across individual diodes. The value of the capacitance will depend upon the number of diodes in series, the capacitance to earth of any diode and the phenomenon of hole storage. The value of the resistor depends upon the worst leakage current any production diode can possess. The losses in the resistors add to those of the rectifiers, but are a fraction of the latter's loss. One advantage of the series string arrangement is that it provides a measure of redundancy that enables the assembly to continue to function satisfactorily even in the event of a number of diodes developing a short-circuit condition.

In the table, silicon diodes have size and weight advantages over the other types of rectifiers considered. Taking into account the sizes of all the components in a rectifier assembly, that is, the transformer, the smoothing inductor and filter capacitors, the overall saving of space may not be regarded by some readers as of significance. Taken by themselves, the diodes do show a saving of size and weight. But it would be more pertinent to say that the ability to use space to better advantage in design is more important. Rectifier assemblies can be arranged to fit into a variety of shapes and allow more latitude to the equipment designer so that improved layout of equipment is possible.

The reliability of the individual diodes is of great importance. Devices should have been in production for sufficient time to eliminate teething troubles. For example, one type of diode used extensively is being life tested under working conditions, and to date four million diode hours have shown no failure. Field experience confirms the reliable operation of these diodes. On one type of equipment, 30 transmitters now in operation are amassing 20 million diode hours per year and there have been no rectifier failures or outage due to rectifier malfunction.

At present-day prices, power supplies employing silicon diode rectifiers can cost up to 100% more than those using conventional rectifiers. (The rectifiers can represent from 5% to 15% of the cost of an equipment). Costs of diodes are falling, but even with present-day prices, the overall cost to the user over the life of the equipment is lower when using silicon diodes by the saving in replacements and maintenance costs. The reduction of outage time and freedom from maloperation is a real saving to many users, particularly in the case of unattended operation.



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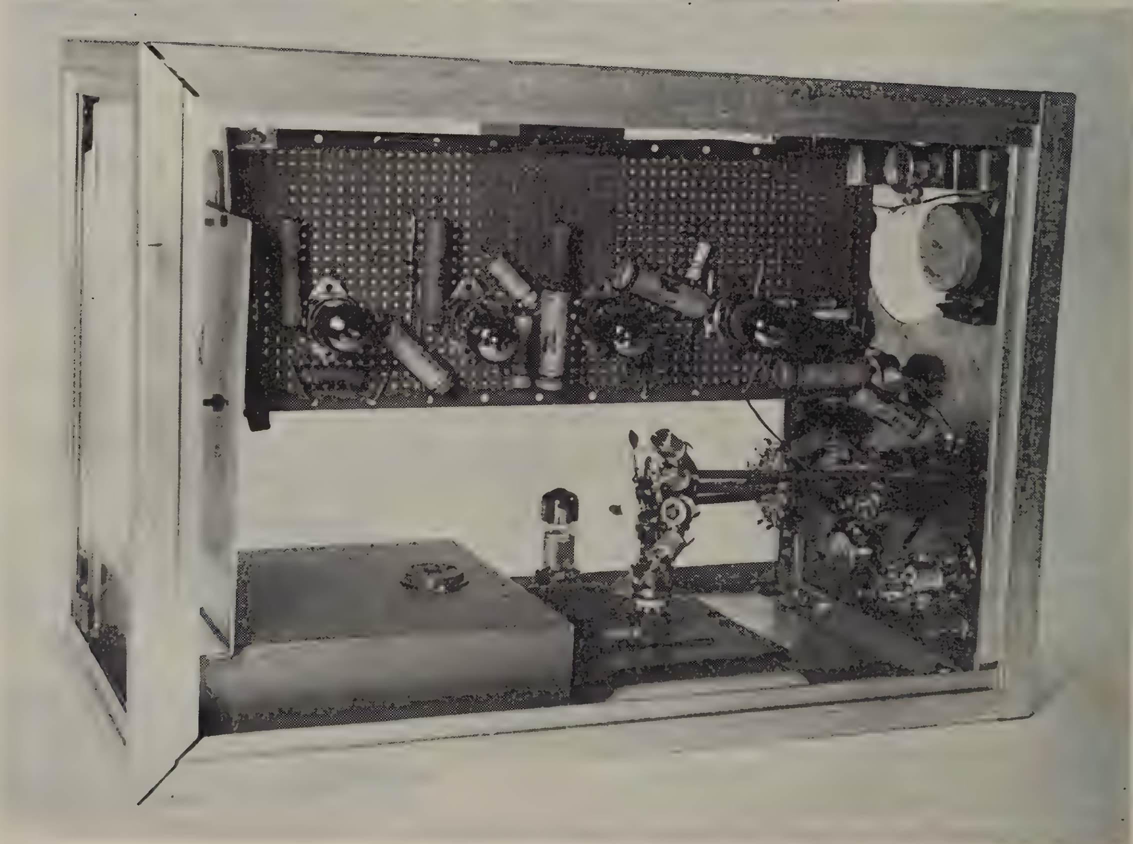
Illustrations : Cabinet from left and right sides — see note overleaf.

Photographs : Barry McKay



"R & E" ADAPTOSCOPE

Constructional Details

by C. W. Salmon

To date, very little has been said about the actual construction of the Cathode Ray Oscilloscope proper. In fact, the use of Imlok frame section and Veroboard makes for a very flexible construction.

Basically, each amplifier is mounted vertically on its respective side of the chassis and the Time Base sub unit is mounted "on the flat" just behind the front panel and below the Time Base range switch.

At the rear of the chassis there is a small, conventional, chassis on which is mounted the VR tube and the Cathode Ray Tube mounting bracket.

This simple layout plan is shown in the illustrations and it would be quite in order to publish these without any further detail, but a few short comments may give an insight into the reasons behind our design and layout.

Components

One of the difficulties facing us during construction, and still with us, was the shortage of components ideally suited for electronic instruments. Presentable control knobs and high grade insulated terminal strips have been unobtainable in Auckland for the past four months. We ordered instrument pattern knobs for the Adaptoscope four months ago and are still awaiting delivery! For this reason, we have not adopted the usual procedure of making up a parts list and have avoided, where possible, specifying a particular make of item.

However, except for the grid stopper resistors and the plate load W.W. resistors of the Z 759's we recommend all resistors to be of 1 watt rating and all capacitors to be of at least 500v rating (the E.H.T. filter capacitors to be 3kV or 5kV)

For this reason, and for cost, we decided **not** to use plugs and sockets for feeding the leads into the Cathode Ray Oscilloscope proper from the Power Supply. Every additional connection is a potential source of trouble, particularly with the E.H.T. leads.

The negative and positive 2kV leads and the isolated CRT filament leads should be made up from $\frac{1}{8}''$, or similar, coaxial cable with the outer sheath and copper braiding removed. These four leads can be grouped together and fitted into suitable spaghetti tubing. All other leads from the Power Supply (from the Painton outlet) can be in the form of a multicore cable.

Incoming leads should be terminated on a high grade terminal strip mounted on the C.R.T. socket bracket, and suitable holes made in the back wall of chassis. Use the coaxial lead (stripped down) for all internal connection in the negative 2kV line such as the brilliance and focus controls and also for the positive lead to the PDA connection on the C.R.T. Use 7 individual 1 Megohm resistors in the negative chain !

C.R.T. Mounting

The rear mounting plate (attached to the VR chassis mentioned above) is 14 inches from the front panel and allows the C.R.T. to project $\frac{1}{8}''$ through the panel so that a hood can be readily fitted if required. The centre the the CRT socket is $8\frac{7}{8}''$ up from the bottom of the chassis. A high grade socket will be provided with the C.R.T. if requested and this needs only a single hole fixing. This should be done so that the socket can be rotated for correct plate alignment.

Seven and a half inches from the front panel is the C/L of a support bracket which is mounted from the underside of the Imlok section. This can easily be made up from 2" aluminium strip of 16 or 18 guage folded into $1\frac{1}{2}''$ x $\frac{1}{2}''$ angle. This angle sits across the top of the chassis and from it can be hung a U piece into which the C.R.T. sits, but first $\frac{1}{4}''$ or $\frac{1}{2}''$ rubber or plastic foam should be placed underneath the tube. The tube can be secured in the U piece by a number of simple ways but we adopted the use of a cross piece fitting horizontally inside the U and screwed on with foam rubber used to hold the tube down. The C.R.T. at this position is $2\frac{1}{8}''$ diameter approximately. This support is shown in the illustrations, but without the horizontal strap.

Veroboard Mounting

The method of mounting the X and Y amplifier panels will be seen clearly enough from the illustrations. The mounting bracket from the potentiometer support (at the front end) should have a slight dog leg so as to clear the C.R.T. glass by $\frac{1}{4}''$ or so.

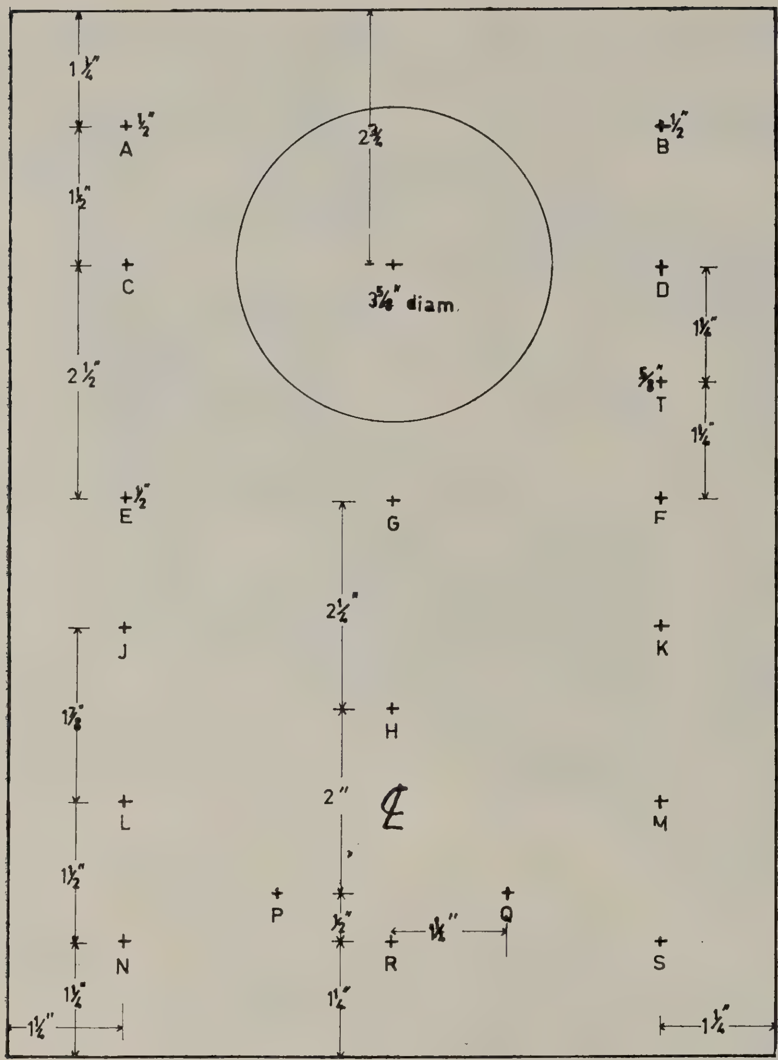
The TB Veroboard panel is supported on a small bracket at the front just under the wave change switch and the back support is obtained from the V.R. chassis. This method gives access to both sides of the vero panel (with the bottom cover off).

Front Panel Layout

This is as generally shown in the illustration but constructors should check their own layouts as switches, knobs and so on may take more or less space than our prototype. This is particularly the case with the X and Y shift controls (10 k WW Potentiometers). These should not be miniaturised types as the larger patterns (5 W nominal) offer much better resolution.

The switches used for the X and Y attenuators should, if possible, have more than the 4 and 3 positions required respectively. This will allow for future calibration in more than 3 positions for the input.

The **Brilliance** and **Focus** controls should be insulated from the panel, as shown in the illustrations, by mounting on a paxolin



11¼" deep ; 8¼" wide.

strip. Drill ½" clearance holes in the front panel so that the metal shafts are well clear of the earth — the potentiometers are at about 2kV to earth. Make sure the grub screws do not project !

Time Base H.F. Ranges Calibration

The effective ranges and individual range sweep will depend a little on stray wiring capacites. It is best to set up the required (or optimum) ranges by trimming the "transitron" capacitors (which are Philips 3-30 pf) by hand against known inputs. This will also allow for best fly-back to be chosen.

Final Setting Up

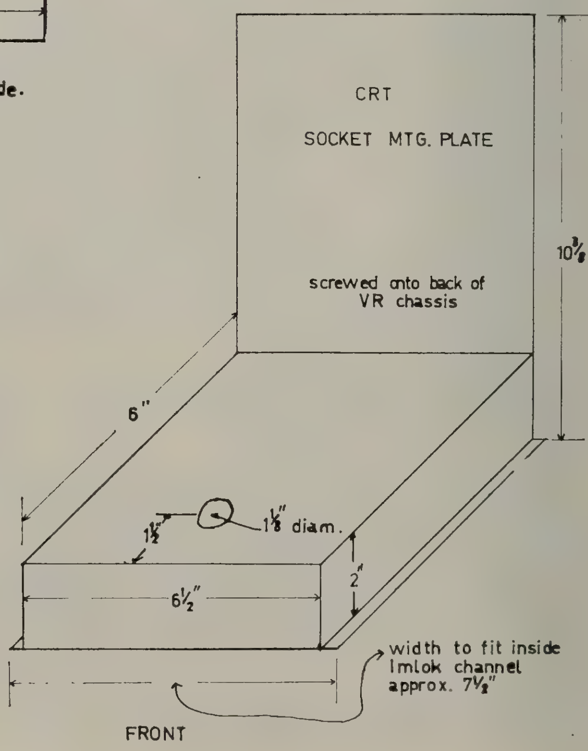
This should present no trouble but care should be taken to ensure that balance of the final Z759s is achieved with the cathode bias adjustment as described earlier. A final issue will give details of test voltages and range performances.

Correction

In the circuit diagram published in December, the values of R30 and R80 (Y and X shift controls) were omitted — these are: 10k ohm, each, WW potentiometers.

A Brilliance
B Focus
C Y Shift
D X Shift
E EHT for CRT on/off switch
F TB Expand
G TB fine frequency
H TB range selector switch
J Y gain
K Y gain
L Y attenuator
M X attenuator
N Y input coaxial socket
P Sync selector
Q Sync level
R Sync input coaxial socket
S X input coaxial socket
T Pilot lamp

Above: Front Panel Layout. All holes not dimensioned. Drill to suit controls (check panel exactly to suit Imlok recess surround).



At right: Voltage Regulator Sub - Chassis.

Note to illustrations on previous page

Showing Adaptoscope during final assembly with the X amplifier Veroboard still to be mounted. Note the TB panel mounted on the flat below the TB range selector switch. See, also, the method of mounting the Brilliance and Focus controls so as to insulate them from earth. The sub chassis at the back holds the V.R. tube and the CRT socket mounting bracket at the rear. (The CRT socket bracket in the photo is not identical to that detailed in the text and drawing).

BELL TV

23″ Receiver
MODEL TV202

INSTALLATION PROCEDURE AND PRESET CONTROL ADJUSTMENT

Receiver Present Control Adjustments

The Bell television receiver has been adjusted for optimum operation before leaving the factory, but if any adjustments are required the following procedure should be carried out on a **test pattern.** Never try to adjust a television receiver on anything but a test pattern.

Centring the Picture

The picture may be centred on the screen by means of two flat magnetic plates directly behind the deflection yoke. One plate is used to shift the picture up or down and the other to shift the picture left or right. If the picture is tilted to either left or right, this may be corrected by loosening the two brass screws on the clamp at the back of the deflection yoke, rotating the yoke slightly to correct the tilt and retightening the screws.

Horizontal Linearity

Horizontal linearity is adjusted by means of the linearity coil L1. Loosen the moulded hexagon screw and move the wire ring in or out until correct linearity is obtained, then tighten the hexagon screw. Greatest change in linearity will be made to the left hand side of the test pattern.

Vertical Linearity and Height Controls

Any adjustment to these controls must be carried out on a test pattern. With the linearity controls correctly set, the height should be set so that the top and bottom of the picture is just outside the edge of the mask.

Line Amplitude

Having completed the vertical linearity and height adjustment, the boost control may be adjusted for the correst aspect ratio. It is then necessary to ensure that the boost voltage has not increased in excess of 850 volts (measured with a V.T.V.M.), when the brightness is set at minimum and the contrast at maximum. The mains voltage during this check should be 230 volts.

Line Oscillator and Phase Discriminator

With signal applied, (a) Short grid of reactance valve (V202a) point H to earth. Adjust slug of line oscillator for zero slip. (b) Remove this short, then short to earth the junction of C210, C209 and R. 210 point G. Adjust phase discriminator balance control for zero slip.

Channel Selector and Fine Tuning

The channel selector should be set to the required channel and then the fine tuning control should be pushed in and rotated in an anti-clockwise direction until the picture starts to "break up." Clockwise rotation until the "break-up" just disappears will produce the optimum tuning.

Volume On/Off Control

A push-pull type of mains switch is used which allows the receiver to be turned on and off without altering the setting of the volume control. This control should be set for a comfortable room listening level.

Tone Control

Rotate until the preferred frequency response is obtained. Anticlockwise rotation reduces the high-frequency response.

Brightness and Contrast Controls

Turn both controls fully anticlockwise. Turn brightness control clockwise until the test pattern is just visible. Turn contrast control clockwise until the peak white information is at the desired degree of brightness. It may be necessary to readjust the brightness control slightly to ensure that the black portion of the grey scale remains black.

Vertical Hold Control

Set this control so that the picture rolls slowly downwards. Now reverse the rotation of the control until the picture moves up, then locks. This is the correct position for best interlace and lock of the picture.

A.G.C. Control

This is the last preset adjustment to be made to the receiver. Switch the channel selector to an unused channel (i.e. Channel 12). Turn up volume control and tone control. Adjust A.G.C. control for maximum audible noise, or maximum noise as seen on screen. This is the correct position of this control.

ALIGNMENT INSTRUCTIONS FOR THE BELL TV 202. FRAME GRID VISION I.F.

Equipment required: Oscilloscope, Sweep Generator, Marker Generator, Bias Voltage Supply.

Vision Alignment

Use 68K resistor and .47 400 volt condenser in series with and amplifier lead for all measurements. During alignment keep generator output at minimum necessary to give accurate results.

(Please turn to page 22)

BELL TV

23″ Receiver Model TV202

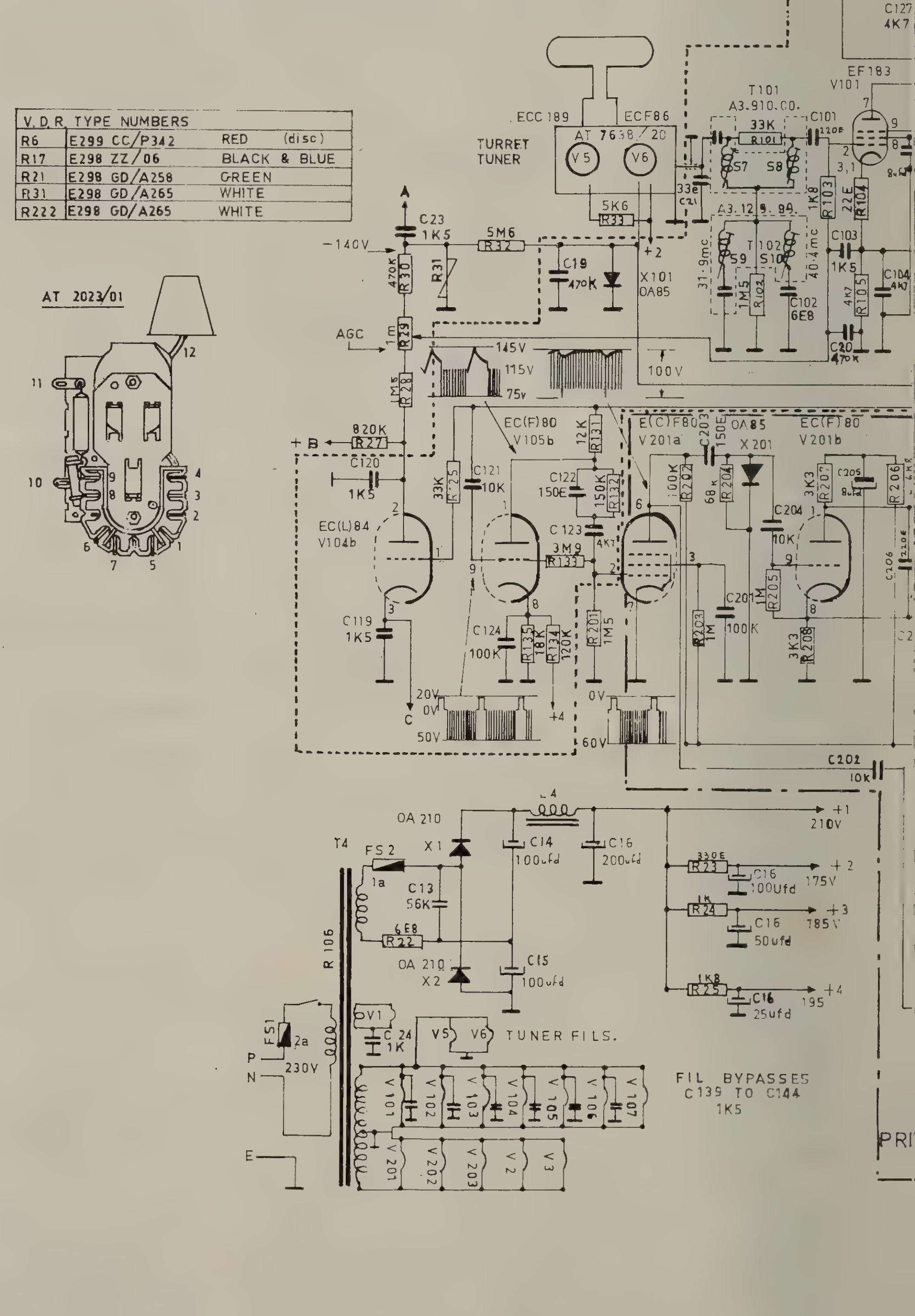
continued from page 19

Main Circuit

			1	2	3	4	5	6	7	8	9
V 1	AW59/91	C.R.T.	6·3~	20	420	200			80	6·3~	
V 2	EL500	LINE OUTPUT	−60		E	E	6·3~		190		850
V 3	EY88	BOOSTER DIODE				E	6·3~				210
V 4	DY86	E.H.T. RECTIFIER	17·5K.V.								
V 5	ECC189	R.F. AMP.	HT 178 V								
V 6	ECF86	MIXER OSC.	HT 150 V								
V 101	EF183	1st VIDEO IF	65	63	65	6·3~	E	E	165	130	63
V 102	EF184	2nd " "	·35	0	·35	6·3~	E	E	165	70	E
V 103	EF184	3rd " "	2	0	2	6·3~	E	E	165	170	E
V 104	ECL84	VIDEO AMP. & A.G.C.	90	580	130	E	6·3~	80	0	−0·5	150
V 105	ECF80	1st SOUND IF & NOISE INVERTER	90	−1	130	6·3~	E	180	0·4	25	−7
V 106	EF184	2nd " "	2·5	0	2·5	6·3~	E	E	185	125	E
V 107	ECL86	A.F. AMP.	0	2	200	E	6·3~	190	4	0	160
V 201	ECF80	SYNC SEP & PHASE SPLITTER	110	−8	90	E	6·3~	160	E	32	28
V 202	ECF802	LINE OSC & REACTANCE TUBE	185	−30	175	E	6·3~	145	3	3	0
V 203	ECL85	FRAME OSC & OUTPUT	75	−40	E	6·3~	E	210	190	16	0

ALL VOLTAGES MEASURED UNDER NO SIGNAL CONDITIONS WITH A V.T.V.M..
CONTRAST CONTROL IN MAXIMUM POSITION & BRILLIANCE CONTROL IN MINIMUM POSITION

V.D.R. TYPE NUMBERS		
R6	E299 CC/P342	RED (disc)
R17	E298 ZZ/06	BLACK & BLUE
R21	E298 GD/A258	GREEN
R31	E298 GD/A265	WHITE
R222	E298 GD/A265	WHITE



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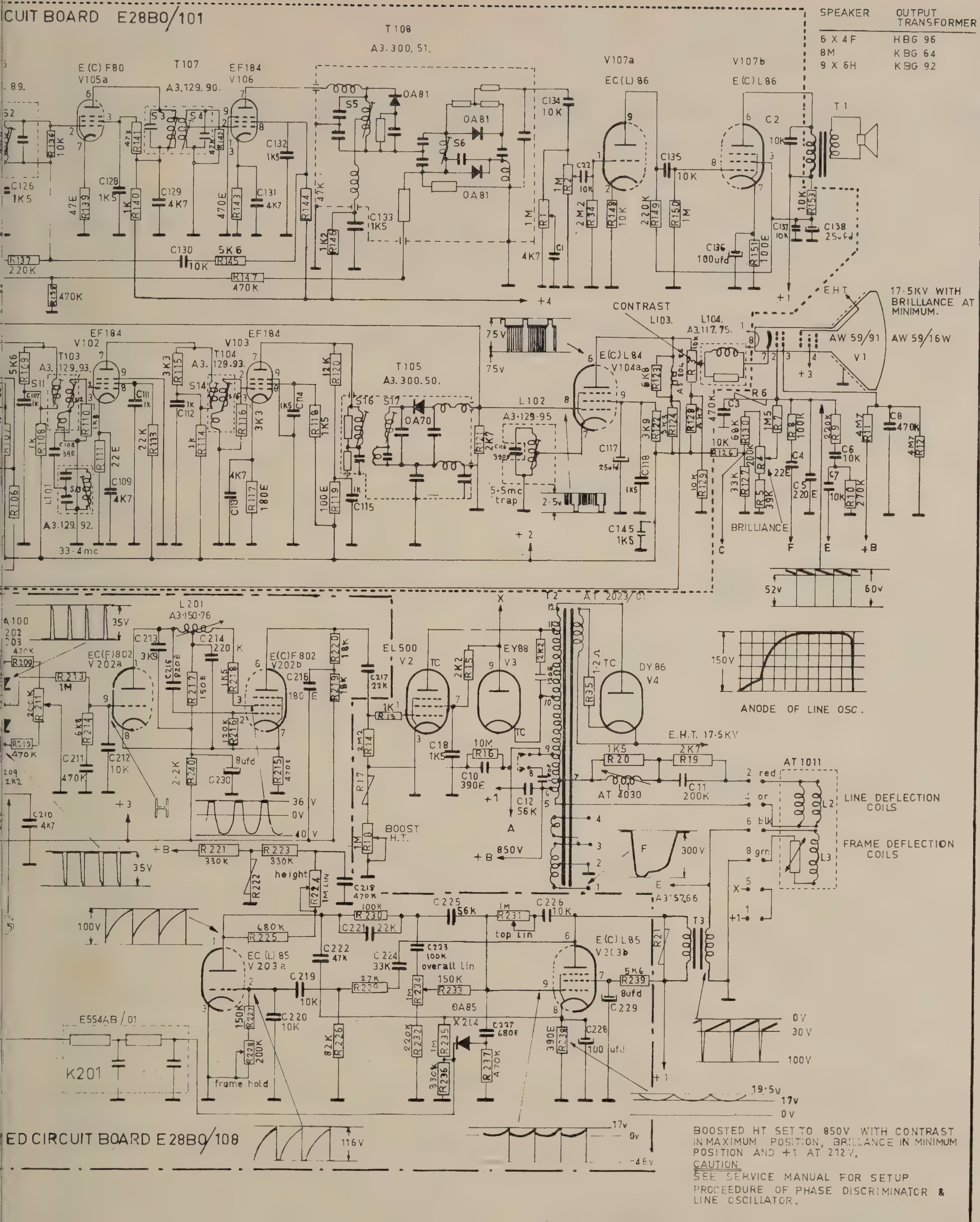


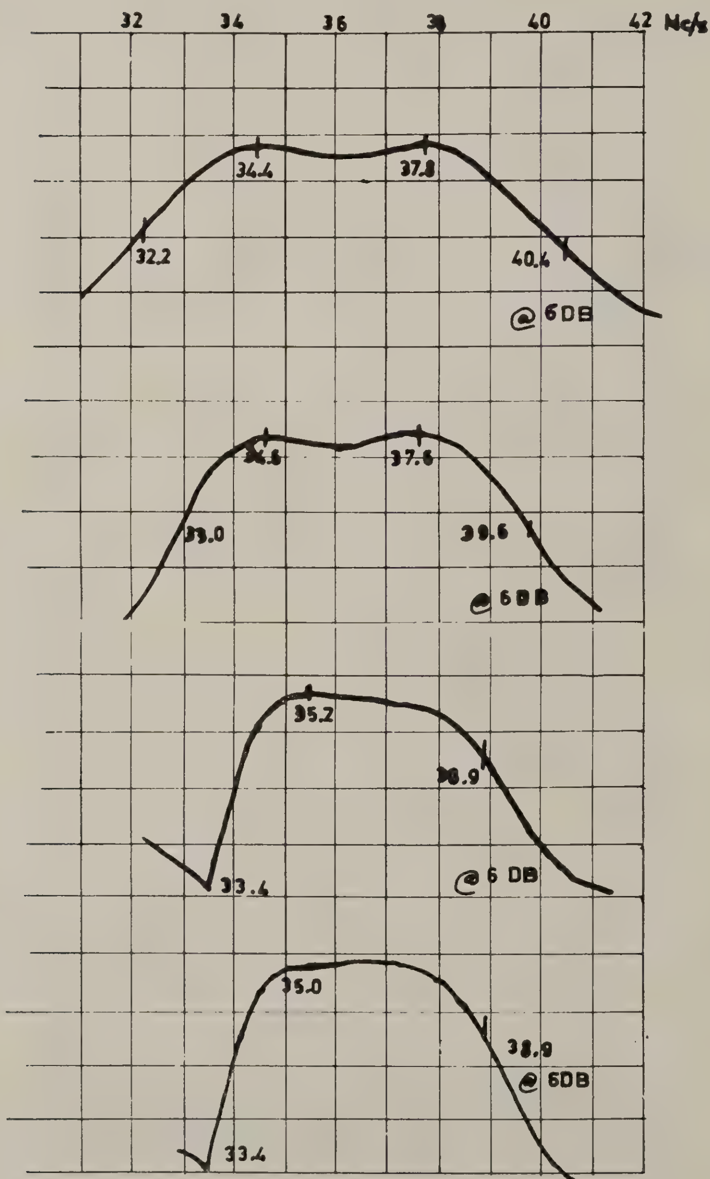
SERIAL Nº 19301	DATE 1-6-63
23" FRAME GRID	TV 202

VISION CORPORATION LTD.

BELL RECEIVER TV202

(continued from page 19)

Connect 6 V bias across C. 103 with positive lead to pin 9 of V. 101.
Connect oscilloscope Y amplifiers lead to C.R.T. cathode lead.
Turn contrast control to maximum.
Set tuner to an unused channel.
Connect the output lead from the sweep generator to pin 2 of V. 103.
Set sweep generator to sweep over the I.F. band then tune S. 16 and S. 17 to give response as shown in figure 1.
Change the sweep generator lead from pin 2 of V. 103 to pin 2 of V. 102, and tune S. 14 and S. 15 to give response as shown on figure 2.
Next inject the sweep generator signal into the grid of V. 101 through C. 101.



Vision I.F. (figures 1 - 4)

Tune S. 13 for a minimum at 33.4 and tune S.12 and S. 11 for response as shown in figure 3.
Change sweep generator lead from C. 101 and connect to M2 on tuner.
Tune S. 9 for dip at 31.9 mc/s and S. 10 for dip at 40.4 mc/s.
Next tune S. 7 S 8 and tune I.F. to give response as shown in figure 4.
This completes the vision I.F. alignment.

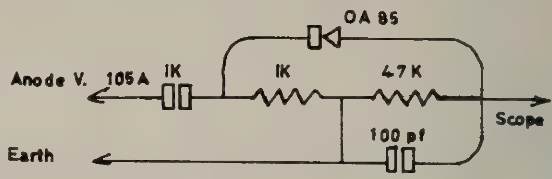


Fig. 5.

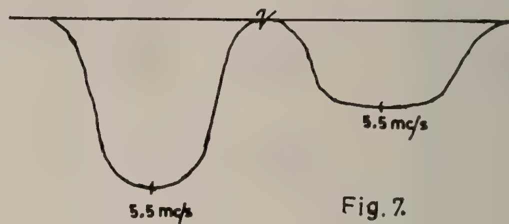


Fig. 6.

Fig. 7.

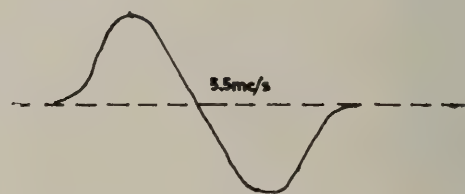


Fig. 8.

SOUND I.F. ALIGNMENT

Connect bias of 4·5 volts between junction of R 138, R 147 with positive lead to chassis.
Connect scope lead to anode of V 105A dia diode probe as shown in figure 5.
Where possible use 5·5 mc/s crystal otherwise set sweep generator to 5·5 mc/s and connect to sound take off coil (junction of R 121, L 102 and C 125).
Tune S1 and S2 for maximum response at 5·5 mc/s.
Response should be as shown in figure 6.
Change scope lead from anode of V105a to anode of V 106.
Adjust S3 and S4 for maximum gain and symetrical response as shown in figure 7.
Remove diode probe from oscilloscope and connect oscilloscope to output of sound discriminator, i.e. C. 134.
Adjust S 6 to give 5·5 mc/s in centre of curve and adjust S5 for maximum response.
Required waveform is as shown in figure 8.
Connect scope via diode probe to anode of V 104 A and tune L 102 for maximum dip.

SERVICEMAN'S COLUMN

by J. WHITLEY STOKES

By the time you read this, another Christmas will have come and gone and what have we got to show for another year's work? For the younger generation — an increase in that invaluable commodity — experience, the same holding true for the older generation with probably the addition of a few more grey hairs as well !

For many this will be the time of year when thoughts of holidays will have to, reluctantly, be put aside for another year while we again take up test prod and soldering iron to do battle with the wily "intermittent," to seek out the missing volt and erratic ohm, the nett result of which we hope will be another satisfied customer.

The following item of news from an American publication recently caught my eye. Three television servicemen were found guilty of "cheating and swindling" and suffered penalties ranging from $200 to $1000. No mention was made as to who was the investigating body responsible for the prosecutions, but the methods used by the investigators would probably bear some investigating, too. Apparently, some television receivers which had previously been checked over and were in good working order were sprung on the unsuspecting serviceman with the request that they be "repaired." As the owner of a television set doesn't usually call a serviceman unless there is something wrong or unless he (the owner) thinks there is something wrong, surely no serviceman can be blamed for proceeding on this basis. Unfortunately, full details of the cases weren't given, but the main cause for complaint seems to have been that certain parts were replaced unnecessarily. It seems to me that in certain circumstances, at least the desirability of replacing a doubtful component can well be a matter of opinion.

The foregoing brings to mind a similar investigation of unethical practices by radio servicemen conducted by the Reader's Digest in 1940. The publication of the article, entitled: "The Radioman Will Gyp You," caused quite a stir in the American radio trade at the time. In this case, the method used was to introduce an artificial fault (such as the cutting of a voice coil wire) into a receiver and then take the set from shop to shop asking for a quotation on the cost of repairs. In this case the set were not actually left for repair so no opportunity was given for any crime to be committed.

So far nobody in this country seems to have felt the need to do any such investigating, but I would like to mention another matter which is not entirely unconnected with the above. The N.Z. Consumer Council recently conducted tests on some electric shavers and in the process decided to test the efficiency of the servicing facilities also. This was done by deliberately damaging three shavers by dropping them on the floor (a fourth damaged shaver which was mentioned was presumably accidentally damaged) and then returning them to the firms concerned without revealing the identity of the council. In each case a note was included which varied slightly in the wording but stated that the shaver concerned had been dropped and with the request that necessary repairs should be done. Without going into too much detail the outcome of the servicing tests was "The repairs were truly assessed and charges made according to work done."

As a serviceman this pleases me no end, but remember brother — next time you or your firm sells a shaver to some guy who brings it back in a damaged condition, watch out !

I wonder if you will be as surprised as I was to learn just how far afield Radio and Electrical Review is going? Apart from regular and increasing quantities to Australia, ye Ed. recently informed me that 20 copies had just been sent off to Peking. Copies are also regularly sent to such places at Britain, Japan, Russia and U.S.A.

I recently received a request for help from my old friend Jack Darr (now Service Editor of Radio and Electronics magazine) regarding information on a rather elaborate signal generator manufactured about 1947 in the U.S.A. Apparently the manufacturer is now out of business so no information was available from that source. An acquaintance of his remembered an article on it appearing in the then Radio News magazine but the particular issue seemed unobtainable anywhere. Could I help? As luck would have it I could as I had the particular number concerned and was able to send off a reply the same day giving the required information. Any more requests anybody?

LOOKING AT

CRYSTAL CONTROLLED OSCILLATORS

Part 2—Quartz Crystals

The first part of this series appeared in the October 1963 issue of this journal.

The object of this article, in addition to complimenting the first part, is also an endeavour to outline some of the properties of quartz crystals for those, who, although working or using such devices, are not familiar with some of the technical terms, properties, and effects, associated with quartz resonators.

The Mineral - Quartz

Quartz is one of a number of pure forms of silica — chemically known as Silicon Dioxide Si02. The supply of this material was found in the Alps in the early times, but today, the supply of raw quartz comes almost entirely from Central Brazil and the island of Madagascar. In the last few years work on preparing synthetic quartz has been successful, particularly with respect to the problem of producing mother crystals free from flaws — one of the problems associated with the use of naturally occurring raw quartz.

Natural quartz occurs in a variety of crystalline forms, but the ones selected for use in quartz resonators are generally in the form of bars of quartz, somewhat hexagonal in cross-section with six faces, and capped at one or both ends by irregular hexagonal pyramids.

These crystals are found in two forms; a right-hand and a left-hand configuration. In the past there has been some confusion since the Crystallographers' and Physicists' definitions have not yet agreed. So far as the use of quartz, in the role of resonator for the control of frequency is concerned, the matter can best be explained by defining the axes of the crystal — there are three — in the following way.

The Axes of a Quartz Crystal

Many text books show a typical section through the centre of a quartz crystal as a hexagonal. Normally, however, adjacent sides are only rarely equal, but in many cases, two or more pairs of sides are similar.

The "Z" Axis

This is roughly a line drawn from vertex to vertex of each pyramid cap. It is more accurately defined as the line along which the crystal has unique optical properties, with only 1 refractive index. The crystal along this line is not piezo-electric (see later).

The "Y" Axis

This is sometimes referred to as the Mechanical Axis and there are three of these axes present in every quartz crystal. If we view the sample along the "Z" axis, the Y axis lies in a plane at right angles to the Z axis, and is perpendicular to a pair of opposing faces. Starting at any particular point the axes are numbered Y1, Y2, Y3.

The "X" Axis

This is often referred to as the Electrical Axis. There are also 3 "X" axes and these also lie in a plane which is at right angles to the Z axes. The "X" axes also lie at right angles to the "Y" axes, in the same plane, in many cases passing close to the angle formed by the junction of two

STOLEN TELEVISION SETS

Between 5.45 p.m. on 24th October, 1963 and 8.15 a.m. on 25th October, 1963, the premises known as Read Marine, situated at 461 Princes Street, Dunedin, were unlawfully entered. From the shop interior four portable televison sets of a total value of £436/-/- were stolen.

Description: Four "Autocrat" portable television sets, serial numbers 105076, 107198, 107392, 108140. All are 14" x 12" x 12" grey metal cases with white fronts surrounding a 14" screen. Firm's reference numbers are painted in black paint at the top, back of each set. Numbers are: 103, 104, 106 and 107.
When new, these sets were fitted with telescopic aerials. However, these have been removed and a cream adaptor fitted for a portable aerial.
Should any information regarding these sets come to your notice, please contact the nearest Police Station.

A suitable reward will be paid for information leading to the recovery in good condition of any or all of the television sets.

adjacent faces. Generally, the X1 axis is found at right angles to the Y1 axis, the X2 axis lies at right angles to the Y2 axis and so on.

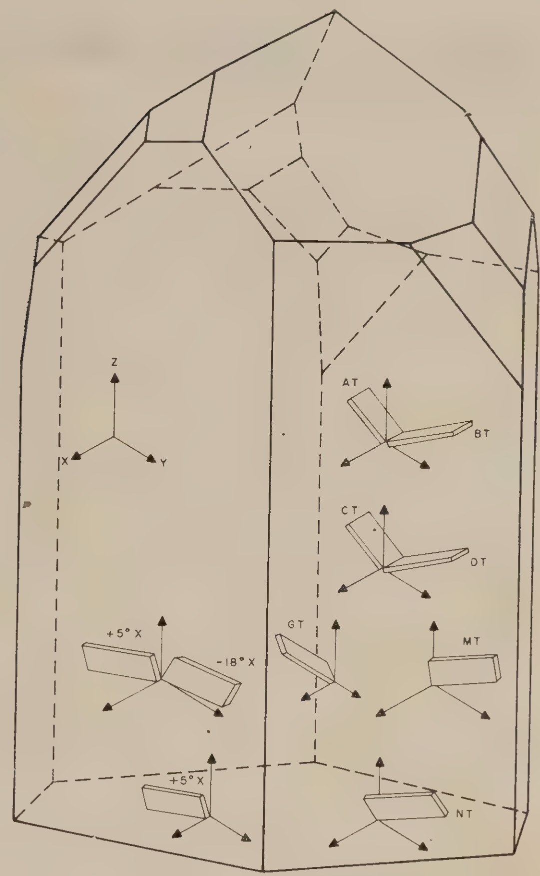
We are now able to define what is meant by an X cut, a Y cut or a Z cut — terms we will be using later on.

1. An "X" cut plate or bar has its smallest dimension on the X axis, and its main plane or surface contains the Y and Z axes.
2. A "Y" plate or bar has its smallest dimension in the Y axis. Its main plane contains the X and Z axes.
3. A "Z" cut plate or bar has its smallest dimension in the Z axis. Its main plane contains the X and Y axis.

One on-axis cut — the "Z" cut — will not be considered further as this cut is not piezo-electric. Prior to about 1936, most cuts in common use were either X or Y axis cuts. After this time off-axis cuts were gradually introduced with their better attendant properties and suitability for particular applications. These will be covered in more detail a little later in the article.

At this juncture we must clarify one point. We commonly refer to quartz resonators as quartz crystals — in fact, these are only plates cut from a section of a quartz crystal, in a particular manner. However, the name is very commonly used in texts, and other references, and for simplicity we intend to use it also in further discussion in this article.

Quartz crystal model showing commonly used cuts of quartz plates in their respective orientation.



Quartz Crystal Oscillators

In general, the frequency stability of an oscillator is dependant upon the Q or Quality Factor (sharpness of resonance) of a tuned circuit, and the temperature and mechanical stability of the frequency determining tuned circuit components.

Changes in phase shift in the oscillator feedback path, will cause the frequency of oscillation to shift until the reactance of the resonant circuit provides the 360° phase shift through the amplifier and feed-back loop. Therefore, the higher the resonant circuit Q, the smaller will be the frequency shift for a given variation of one or more normal operating conditions.

The Q of conventional tuned circuits is limited by the Q achievable in the inductance component. About 300 is the maximum value of Q that can be obtained in practice.

Because of their high Q and relative temperature stability certain electro-mechanical resonators have achieved widespread use as resonant circuits in oscillators where frequency stability is important. Foremost amongst these electromechanical resonators is, of course, the quartz crystal plate.

Certain materials, including crystalline quartz exhibit a property of exchanging energy between electrical and mechanical states, i.e., a mechanical force applied in the proper direction to the material will cause an electrical charge to appear on the surface of the material, and conversely, an applied electrical potential across the surface of the material will cause a mechanical displacement of the material.

This is commonly known as the Piezo-electric effect. An alternating voltage of the correct frequency applied across the correct sides of a suitable quartz crystal plate will cause it to vibrate mechanically. The mechanical vibration exhibits a resonance at a frequency which is determined by the dimensions of the quartz crystal plate.

At this resonant frequency the exchange of energy between the electrical and mechanical states is very efficient and very little energy is dissipated in the crystal. The frequency of this resonance is very sharply defined because quartz crystals exhibit equivalent Q's of the order of 10,000 to 100,000 or more. Also the physical and electrical properties of quartz have small temperature coefficient.

A crystal unit suitable for use in an oscillator consists of a quartz plate equipped with suitable electrodes and mounted on a holder in such a manner that will allow it to vibrate freely in the desired mode of vibration. This will be discussed more fully later in this article.

LOOKING AT CRYSTAL CONTROLLED OSCILLATORS

Part 2—Quartz Crystals

In preparing a crystal, the large piece of mother quartz is first sawn by high-speed impregnated diamond circular saws into wafers which are oriented with respect to the X, Y, and Z axes of the mother crystal so as to give the desired electrical properties. The plane of the crystal blank is normal to the designated axis. The saws used for this part of the work rotate at high speed and because the material is crystalline in form, the quartz wafers are usually kept relatively thick, then being reduced in thickness further by the use of diamond grinding machines. To facilitate close control of the correct cutting process, the wafers are examined by x-ray and optical instruments.

The wafers are then diced into blanks of approximate size and reduced in thickness by stages of lapping until almost the proper dimension for the desired frequency is obtained. The blanks are then passed for finishing to another section of the works. Here they are carefully cleaned, and brought to frequency by etching, for pressure mounted type crystals. For plated type wire mounted crystals, the etching is stopped when the correct pre-plating thickness is reached. After treatment in this way the blanks are cleaned, nowadays using ultrasonic cleansing methods, and then often aged by heat cycling, to minimize frequency variations during use, due to ageing. The blanks are plated to correct frequency, mounted in evacuated glass or metal holders, or mounted in an inert gas in other types of holders.

The crystals, when they are finished, are usually not flat, many having a slightly convex contour for fundamental frequency operation in the region of 1 to 20 mc/s. This is an aid to suppressing unwanted resonances in the crystal.

The Various Modes of Oscillation of the Quartz Plate

There are four basic modes of vibration, and depending on the orientation of the crystal cut, so a given plate will vibrate in one particular mode. In some cases, however, various modes are possible from the same crystal, depending on such factors as the mounting method and the amount or frequency of the exciting voltage.

One mode, called the torsional mode, is purely of historical interest. As the name depicts, this mode is characterised by a twisting motion around the long axes of the plate. This mode, now no longer used, was used for very low frequency resonators in the early days of crystal control.

The second type is called the *flexure mode* of oscillation. This is a fairly recent addition to quartz crystal techniques; and is characterised by the fact that the length governs the frequency of oscillation similar to a string of a stringed instrument. For this reason, the flexure mode quartz unit is used extensively for the audio and supersonic range of frequencies. There are a number of methods of obtaining this flexure mode, but in most cases, two pairs of supports are used and these are located a distance of ·224 times the length of the bar, from each end.

The next step up the frequency versus mode ladder is the *longitudinal mode.* This is sometimes called the *compressional mode.* The bar has a centre mode and the material is displaced lengthwise by the field which is applied to the larger surfaces. The vibration occurs in a way so that the bar is periodically elongated, with a simultaneous reduction in thickness of the plate. This mode is useful, in addition to frequency control functions, for applications connected with ultrasonic crystal transducers. As the mode forms a useful step between the low frequency flexural mode, and the higher frequency shear mode.

The fourth and most common and versatile mode is the *shear mode.* There are two forms of shear mode, the face shear, and the thickness shear.

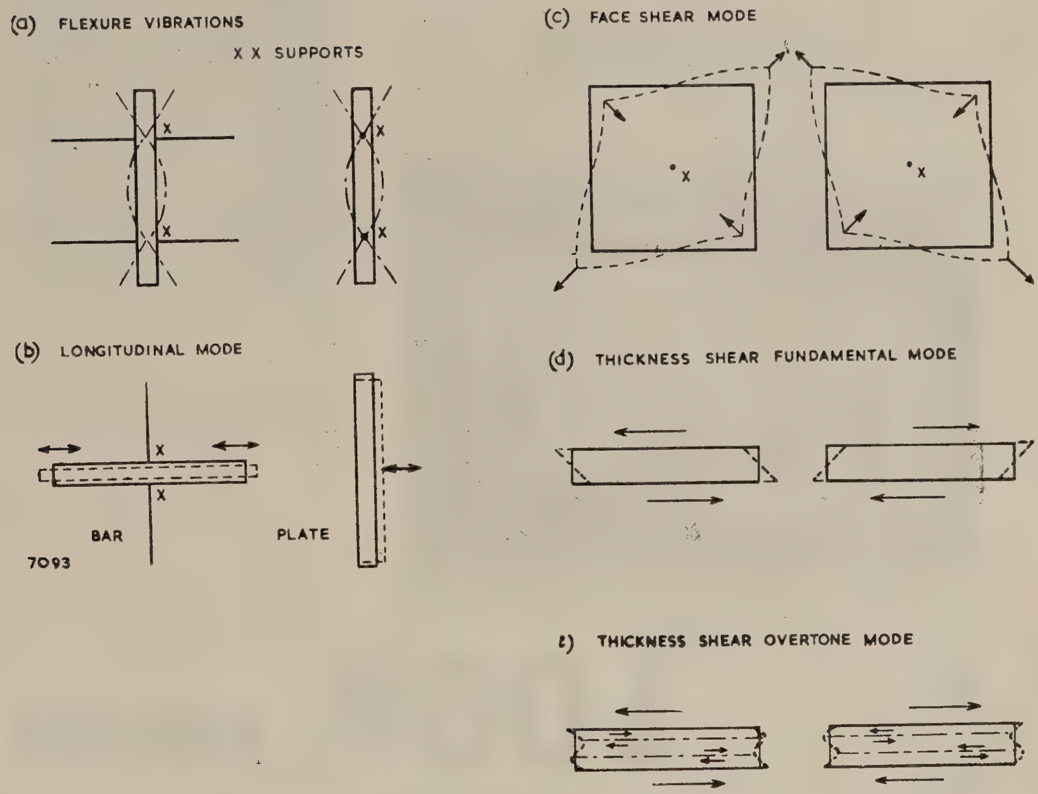
This mode of vibration tends to shear the crystal along either its face, or its thickness. The face shear mode is normaly used with a square plate. The support is at the centre mode, and distortion takes place as the plate tends to a diamond shape, alternately, along the two diagonals. The even overtones of this mode of vibration can be used to obtain a higher frequency from the same size of plate.

By far the greatest proportion of quartz plates manufactured for controlling crystal oscillators operate in the thickness shear and add overtones of this shear. It should be noted that in the case of the flexural mode, the length was the main control of frequency, and the cross section was small. In the case of the thickness shear mode the frequency is controlled by the smallest dimension — the thickness, whilst the other dimensions are large in comparison.

The flexural mode, and in general low frequency crystals, generally do not give much trouble with unwanted or spurious frequencies since there are no other modes of motion lower than the desired one which can interfere. In the case of the thickness shear, however, the situation is complicated by the fact that all the other modes and overtones can be excited. These modes cannot be eliminated but can be reduced to a safe level for the particular application. The only case where particular care is necessary is when the crystal is the only frequency determining element in the oscillator, for instance, the simple Pierce oscillator.

The following is a list of Types of Crystal Cuts, together with details of their mode of vibration and usual design frequency range.

The various modes of oscillation of a quartz plate.



Type of Cut	Mode of Vibration	Usual Frequency Range
+ 5° X Duplex	Thickness Flexure	400 c/s – 10 Kc/s.
+ 5° X Cut Bar	" "	2 Kc/s. – 16 Kc/s.
N.T. Cut	Face Flexure	3 Kc/s – 100 Kc/s.
+ 5° X Cut Bar	Longitudinal	40 Kc/s. – 200 Kc/s.
C.T. Cut	Face Shear	150 Kc/s – 500 Kc/s.
D.T. Cut	" "	100 Kc/s – 250 Kc/s.
E.T. Cut	" " (overtone)	400 Kc/s. – 800 Kc/s
G.T. Cut	Longitudinal	90 Kc/s. – 250 Kc/s.
B.T. Cut	Thickness Shear	3000 Kc/s – 22,000 Kc/s
A.T. Cut	" "	1000 Kc/s – 20,000 Kc/s
A.T. or B.T. Cut	" " (3rd or 5th Overtone)	15,000 Kc/s – 100,000 Kc/s

It should be remembered that a crystal produced at any frequency in the above range by a number of manufacturers could differ in many respects. There may be a difference in cut, but even where this is the same, the crystals could operate differently under certain conditions.

Because of the extreme thinness (approximate ·006″ at 15 mc/s) of quartz crystals at high frequencies, and their consequent fragility, the operation of quartz crystal oscillators using A.T. type crystals (BT cut is somewhat thicker than AT for the same frequency) at frequencies above 20 mc/s is usually achieved by the use of an odd mechanical overtone of the crystal fundamental resonant frequency. Partially plated crystals are used and operation on the 3rd, 5th, and 7th overtones can be obtained at frequencies as high as 100 mc/s.

The low frequency limit for using quartz crystals in stabilising oscillators is established by the availability of large size quartz blanks suitable for the purpose. Standard commercial crystal units are obtainable for frequencies as low as 15 Kc/s.

The Specification of the Cuts

When the X and Y cuts were the only two types in use, it was quite easy to describe the exact orientation of the plates by means of a few words, e.g.:

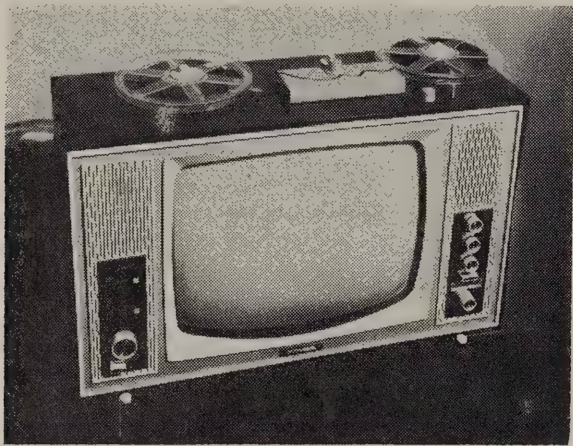
X cut crystals are cut from the mother crystal, by sectioning the plate so that its faces are perpendicular to the X axis, whilst Y cut crystals have their faces perpendicular to the Y axis.

It is quite evident, however, that the discovery of the more complex cuts in which there are various angular rotations of the plate around one, two, or all three axes makes such a description very cumbersome. It is not intended at this stage to outline the methods used for describing the orientation of crystals, but in the diagram of most of the major cuts, these are shown with reference to the axis in the mother crystal.

Some of the benefits, and disadvantages, of the more complicated cuts will be dealt with in the next part of this article.

BRITISH INVENTORS DEVELOP FIRST HOME TV RECORDER

The world's first commercial home television tape-recorder has been developed by a team of British technicians. Called the "Telcan," it is available as an

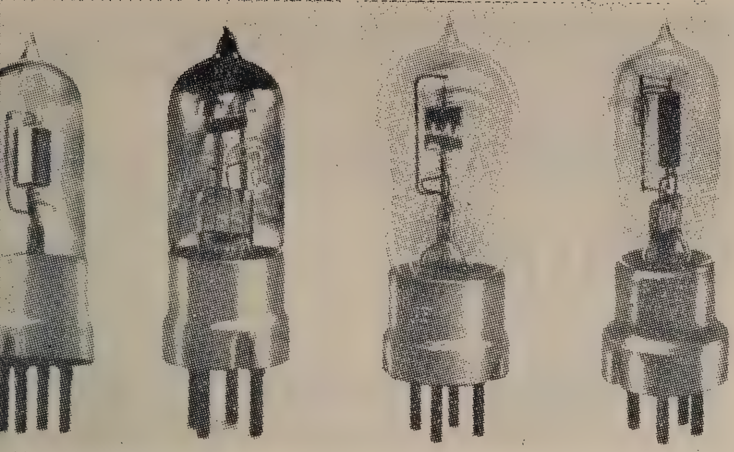


integral part of a television receiver set (as seen here) or as a separate unit, looking very much like a normal tape-recorder. Now your favourite television programme can be recorded and played back at leisure. And for fanatical television fans a modification to the set allows them to watch one channel while Telcan records the other or one of the others where a choice of stations prevails.

Although Telcan immediately presents itself as a domestic plaything, in fact its applications in the field of industry and science are vast. And for educational purposes it would fit in perfectly with the increasing use of television at schools and universities. Lectures and demonstrations could be recorded on tape and used time and time again. And Britain's proposed inter-varsity link-up, where one lecturer speaks to three or four different classes in various parts of the country, through the medium of television, could be extended to an international exchange, with educational bodies loaning tapes.

Cost of an integral unit would add about 25% to the price of a television set.

Manufacturers: Nottingham Electronic Valve Company Limited, Nottingham, England.



Left to right:
Ediswan A.R. Detecting or Amplifier Valve.
Cossar Pink Top Valve, largely used for amplifying ("Tin - Hat")
Mullard Ore Valve.
O.E.3 Marconi - Osram Dullemitter Valve.

• RADIO EQUIPMENT OF YESTERYEAR •

(Continued from page 11)

and it could be employed with an auxiliary battery and relay circuit. Although it had been employed by Hughes unconsciously in 1879, the first deliberate application of the coherer to the detection of Hertzian waves was made by Sir Oliver Lodge 10 years later. Many forms of coherers were subsequently employed and means were devised for automaticaly restoring the coherer to its original condition after the passage of a signal. Many of the first attempts at commercial signalling systems employed coherer detectors but increase of sensitivity always involved a decline in reliability so that other forms of detectors became more favoured.

Exhibit No. 12 — Marconi Coherer

This is an exact replica of the type used by Marconi in his ship to shore communications between 1897 and 1902. The detector is a glass tube containing loose filings of silver and nickel. As mentioned above, these filings normally possess a high resistance, but the arrival of H.F. waves causes the filings to cohere and the resistance drops to a low value. This allows current from a local cell to pass and operate a relay which closes the bell of the bell-like tapper mechanism which, by means of a gentle touch, restores the coherer to its normal high resistance state, ready for the arrival of the next train of waves. In addition to operating the tapper mechanism or decoherer, it also operates a morse inker which receives the dot and dash signals as transmitted.

Exhibit No. 13 — The Original Newton 10-inch

Induction coil used by Marconi in 1898/99 for use between his stations at Alum Bay (Isle of Wight) and Bournemouth, together with a tray of Leyden jars used for transmission purposes by Marconi in 1898 in his earliest experiments.

Exhibit No. 14 — Marconi's original Tuned Circuit (1899/1900)

This is a square wooden frame carrying two windings; one of these is in series with a Leyden Jar and a spark gap, the balls of which were connected to the output windings of an induction coil. The other winding, of one turn, was connected between an aerial and earth. This formed the basis of the famous 7777 patent of 1900.

Exhibit No. 15

Original receiver used by Marconi in Newfoundland in December 1901 for reception of the first wireless signals across the Atlantic. It was on December 12, 1901, that Marconi heard faint signals (the letter S in morse) at St. Johns and recorded them on a coherer and tape recorder. The first signals across the Atlantic transmitted from Glace Bay (Canada) were received at Poldhu, Cornwall, on December 5, 1902.

Detectors (2) — Magnetic Detectors

Rutherford, in 1895, succeeded in detecting Hertzian oscillations at a distance of ¾ mile using a magnetised steel needle in the centre of a bobbin of fine wire. He thereby confirmed the investigations of Henry who had noted the demagnetisation of needles due to discharge from nearby Leyden jars as early as 1842. In 1897 Professor Ernest Wilson constructed a similar device but with an automatic feature whereby the movement of the needle connected the coil to a local battery circuit which remagnetised it and restored it to the condition of detecting further signals. Marconi, in 1902, further improved on this principle by employing two coils wound on a core of soft iron wires in front of which a permanent magnet was rotated by clockwork. One coil was connected between aerial and earth and the other to a telephone circuit, the receipt of signals suddenly overcame the hysterisis lag in the periodic magnetisation of the core and produced a click in the telephones. In a later form, Marconi employed an endless band of insulated soft iron wire driven at about 5 inches per second by two rotating pulley wheels, as the core.

Exhibit No. 16 — Original Marconi Magnetic Detector (1902)

Exhibit No. 17 — Original Marconi Multiple Tuner 1907

Exhibit No. 18

A demonstration spark transmitter made by Marconi and used by him between 1896 and 1900 consisting of an induction coil, a fixed spark gap, aerial coupler and a dipole aerial. This transmitter, one observes, is exceptionally well made and built almost to "last forever," a characteristic of all Marconi apparatus even to the present day.

Detectors (3) — Electrolytic Detectors

An electrolytic detector was invented by Neugschwender in 1898 and one of the earliest practical forms thereof was the de Forest "responser" of 1901. A constant current caused the growth between closely spaced electrodes of crystaline structures known as "lead trees" which was partially destroyed on the passage of a signal current through the detector but was instantly restored as soon as signals stopped. This detector in which the resistance increases with received oscillations is also known as an "anticoherer."

(concluded next month)

Some Aspects of V.H.F. Mobile Operation

by Irving Spackman
ZL1MO

This is the first of a series of articles dealing with some of the technical and constructional matters related to VHF amateur mobile equipment.

PART I

The Mobile Scene

With the marked increase in interest and activity created by the Technician Class of amateur license, and with the advent of many new techniques and components, all coupled with the call of fine summer days, picnics and beach outings, there has been a remarkable amount of interest in VHF mobile equipment and operation. This has been the main reason why this series was conceived.

In addition, as the writer has been present either in an active or observing capacity at a number of recent mobile contests, rallies, etc., and having operated mobile on both low and VHF bands over the last seven or eight years, it has become obvious that, in line with similar thinking which is being applied to home stations, mobile stations should, if they are to be operated in accordance with advancing technical practises, use the frequencies most suitable for the type of operation being contemplated. That is to say, in general, a large amount of the amateur mobile (and home station) operation is between stations located less than 50 miles apart. This is particularly true of 80 metre operation in New Zealand in daylight hours.

It seems high time, that, for a large amount of amateur mobile operation, a move should be made away from 80 metres. It is quite obvious that more use could be made of the VHF bands for mobile service particularly is such facilities are to be used also for civil defence, emergency, or search and rescue work. We all know of the mobile commercial services operated throughout the length and breadth of the country. Whilst these vehicles normally operate with ideally located base stations, the usual working ranges are certainly quite im-

pressive. With amateur mobile equipment working to well equipped home stations, similar ranges can be covered. These distances are generally of the same order, if not better than those which can be achieved by the mobiles using the low frequencies, during daylight hours. At night-time much greater ranges are obtainable by the L.F. mobiles, but how often has a contest over a distance of a few miles at night suffered through one or both stations being affected by interference from a station 500 miles away.

Let's look at other aspects. One of the great advantages of the use of VHF frequencies is the much shorter, less obtrusive and yet more efficient antenna system available. Even a Broadcast whip antenna can be a tolerably good, and quite efficient radiator.

The possibilities of VHF repeater stations is also not to be overlooked. These could provide communication over great distances with low power mobile to mobile contacts the rule rather than the exception. Where the mountainous terrain in this country can normally be the limiting factor to VHF communication paths, the same mountains could, in fact, be a blessing in disguise from the angle of a repeater station.

With the advent of transistorised power supplies, transistorised audio systems, hybrid valve and transistor, and fully transistorised converter and receiver systems, the average VHF mobile installation can be operated with very little more battery drain than comparable low frequency equipment. In fact, the efficiency of overall conversion of watts from battery to energy radiated may be actually higher in the case of VHF equipment.

In this series, we are going to attempt to outline some of the various methods used in generating, modulating, radiating and receiving signals in the VHF spectrum, with the minimum battery drain commensurate with practical values of output power.

Most of the following information will be more applicable to operation on a frequency of 144 megacycles, although similar, and in some cases, simpler equipment can be designed and constructed for frequencies in the vicinity of 50 megacycles. In addition, some thoughts have been given to the aspect of portable/mobile operation on 420 megacycles. There has been little work done on these frequencies for mobile (and for that matter home station) operation, in this country, but in other parts of the world, 460 megacycle mobile commercial equipment is in use quite extensively, and operating over astounding distances. Here is a field for some genuine research work which undoubtedly will be of value at a later date.

Planning a Practical V.H.F. Mobile Installation

The problems of putting a VHF rig in the family car are not great — collectively they may seen to be of unsurmountable magnitude — individually they are simple and generally easily solved with a little patience, some hard work and a lot of common sense.

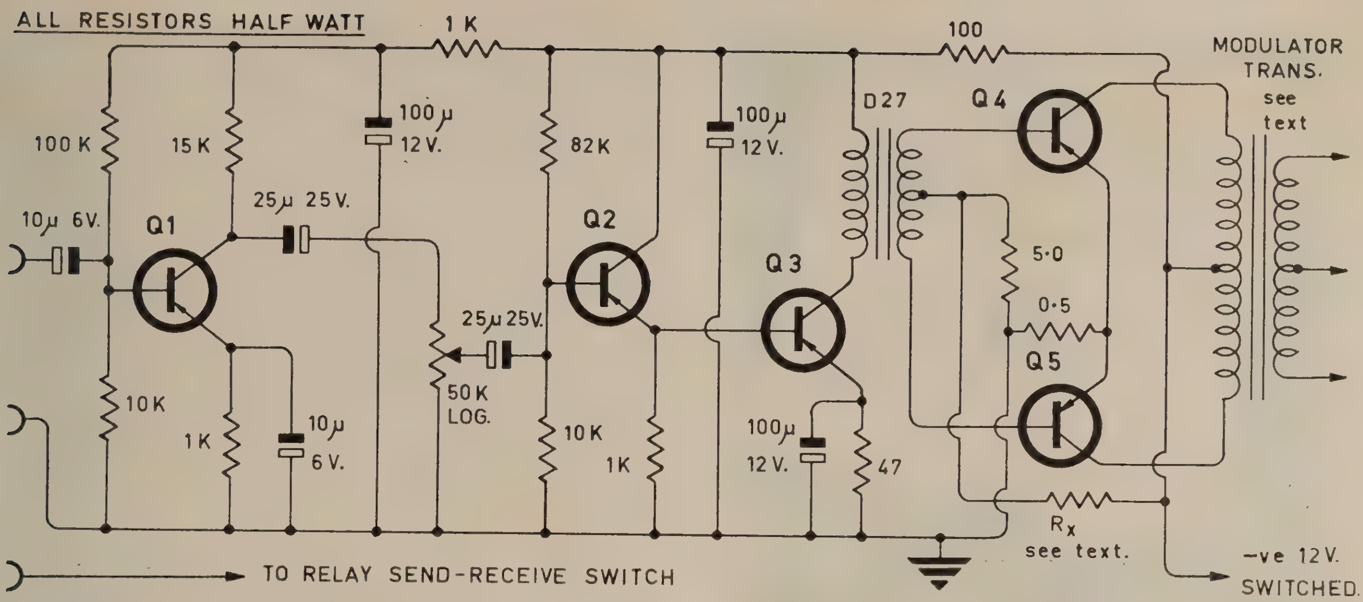
The various factors which are to be covered in this series of articles are itemised below:

1. The car battery — its capability for supplying power and methods of conversion and saving this precious commodity.
2. Problems associated with noises produced by one's own vehicle and those of others in the vicinity.
3. Methods of generating a reasonably powered stable carrier signal.
4. Methods of modulating the carrier produced in 3 above.
5. Methods of feeding the energy produced by 3 and 4 above to an antenna and efficiently radiating it.
6. Methods of receiving the signals from other stations.
7. Last and most important — integrating the system with normal driving procedures so that vehicle control and driver ability are totally unaffected. This is most important in the interests of safe and considerate driving.

Perhaps one of the first thoughts given to the subject is that related to how to fit the mobile gear into the car. E. A. Matthews (G3FZW), the author of the Mobile Column in the September 1963 R.S.G.B. Bulletin has this to say: "The modern small car has much more space available for storage than its counterpart of a decade ago, but this space seems to be distributed about the car in small pockets. It seems logical therefore, to build mobile equipment in sections which can be fitted into the nooks and crannies." He goes on to say "The man who builds his own gear has every advantage provided that he gives sufficient care to the placement of controls, which has a great effect on road safety."

The author's personal preferences are somewhat different. Having been associated, at one time, with the radio-telephone industry, there is a certain pleasure found in producing equipment all combined in a small single package which can usually be mounted under dash or above or below the parcel shelf, handy to the driver and second operator when required, generally quite close to the battery, and usually in a reasonably ventilated position. (This last point is quite important when transistors are being used). By building the equipment in this fashion (similar in many respects to the modern trend to tranceivers), all the unit has in the way of external attachments, are connections to microphone, battery, in some cases speaker and external power unit, and antenna. With VHF equipment, the small physical size of many of the components, particularly coils and variable condensers, allows this single package to be kept quite small. The one unit can be readily removed for alteration or service, whilst the other members of the family are less likely to become tangled with the gear.

The A.R.R.L. Handbook summarises the problem in the following way: "In contemplating a mobile installation, the car should be studied carefully to determine the most suitable spots for mounting the equipment. Then the various units should be built in a form that will make the best use of that space. The location of the converter



10 WATT MODULATOR FOR USE WITH DYNAMIC MICROPHONE

Q1 - AC107 Q3 - OC84 with heatsink clip.
Q2 - OC75 Q4 & Q5 - OC 26's.

should have first consideration. It should be placed where the controls can be operated conveniently without taking attention from the wheel. The following are suggested spots, depending on the individual car: On top of the instrument panel; attached to the steering post; under the instrument panel, or in a unit made to fit between the lower edge of the instrument panel and the floor at the centre of the car.

"The transmitter power control can be placed close to the receiver position, or included in the converter unit. This switch normally operates relays." The article goes on to say, "Depending on the size of the transmitter unit, one of the following places may be found convenient for mounting the transmitter: In the glove box; under the instrument panel; in a unit in combination with or without the converter, built to fit between the lower edge of the instrument panel and the floor at the centre of the car; on the ledge behind the rear seat; in the rear luggage compartment."

There is one thing which is generally required — that of miniaturisation. Another point is that all mobile equipment should have strong and resilient mountings. Once again let me stress at this point — if the station is to be operated by the driver of the vehicle, the layout and control circuits must not distract his attention from the task of controlling the car — if this cannot be achieved then give up the idea of mobile operation. There could be no valid defence if it were proved than an accident was due to the operation of radio equipment by the driver of the vehicle.

It is our intention through this series to try and strike a balance between theoretical or topical discussion, and practical constructional work. It is for this reason that we are going to break from our survey of the various problems and turn to the practical side.

The Transistor Modulator

In the course of planning a mobile station, the problem of battery power conservation will be studied (this is to be covered in the next part). The use of transistors is one of the greatest steps forward in the problem of operating from a storage battery. There are many of our readers who at this juncture become a little apprehensive as to what approach we are going to take — let it be said here and now that we are not going to go "off the deep end" with transistors. There is need, however, for us to be practically minded about this and for that reason, we are first going to introduce the transistors in the Audio Section of our equipment. The constructional feature this month deals with a modulator suitable for modulating transmitters with anode inputs from 10 to 25 watts, when operated from a 12 volts battery source.

We have chosen a simple circuit, generally economical in transistors and other parts, yet capable of good quality performance. After much thought on the subject we have decided to use for this first design a low impedance dynamic microphone — in this instance one of the common war surplus ZC1 type dynamic units. These give better quality than the carbon button types, and are equally as rugged a unit. We do intend publishing circuits suitable for carbon button microphones and high impedance crystal microphones. We do not recommend the use of crystal microphones with the "rochelle salt" type insert. Where possible, if a crystal type microphone is desired, the microphone capsule should be one of the newer "ceramic" types. Both these, and also the modern

magnetic types of hand microphones suitable for mobile service are available from one of the firms who regularly advertises in this magazine.

We have selected transistor types which are readily available. The output pair, which operate in Class B are a matched pair of OC26s, although type 2N301 will work satisfactorily. The OC26s are recommended if more than 10 watts is required from the modulator. If less than this figure is required then either type is suitable. We have selected the driver transistor for the main purpose of controlling the output from the modulator rather than by the use of a varying range of output transistor collector load impedances. This is because we have attempted to use readily available vibrator transformers as modulation transformers — where suitably chosen, they, in fact, work very well as modulation transformers for speech frequency work.

Where we have only wanted outputs of the order of 6 to 8 watts from the modulators, we have successfully used the OC84 driver. Where we have required more output power, up to the limit, say, of 15 watts, then we have had to use the OC30 as a driver transistor. In either case, however, the driver transistor operation is well within the manufacturers ratings.

Selecting the Correct Transformers

In designing the general circuit of this modulator, it was decided that the equipment should only serve as a lead to prospective users. We do not categorically insist that the various transformer types should be lavishly copied; if a different end result is required, of course, then they will have to be changed. Where practical, rather than try to confine our ideas to a particular modulation transformer, which would limit the versatility of the whole series as such, we have used vibrator transformers, and multi-match driver transformers are specified except for certain specific cases.

Let us look more closely at this aspect. The driver transformer has two real requirements. It must provide for power transfer from the Class A driver stage, to the varying base drive requirements of the Class B output pair. The other requirement is to transform the current and voltage ability of the driver transformer to the current and voltage requirements of the base circuits of the output pair of transistors. Let us quote with a simple example. The OC 84 will be capable of handling about 50 mA maximum at a total voltage of 12 volts. All this is not available as drive of course. The 12 volts is developed across the driver transformer, the driver transistor and the emitter resistor of the driver transistor, all in series.

Construction of the Modulator

The modulator is constructed on an aluminium chassis 7'' long, 3'' wide and 2'' deep. This chassis provides the mounting facilities and heat sinks for the transistors, while the modulation and driver transformers are mounted inside the chassis. In this way, the chassis can either be mounted separately in the vehicle, or under a parcel shelf, or in other

locations, or alternatively, can be bolted to the underside of the main tranceiver chassis.

In mounting the two OC 26 power transistors, make a cardboard template from one of the mica washers supplied with the transistors. Use this template to drill the holes for mounting, and to pass the base and emitter leads of the transistors. The case is the collector, and must be insulated from the chassis — this is the reason for the mica washers and the insulated bushes, which are used together with the screws to clamp the transistors to the case heat sink. The modulation transformer is mounted close to one end of the chassis, and the transistors are located in the centre of each side flange. The driver transformer is located almost between the two transistors mounted on the wide side of the chassis. The microphone socket and preset volume control are mounted on the front end of the chassis. The low voltage D.C. and modulated H.T. leads are taken from the opposite ends of the chassis through a half-inch grommett. In the author's case the chassis is used as an earth return, but if the modulator is mounted in an area where it is normally insulated from the body of the car, then a low tension earth return lead will also be needed.

The OC 84 if used for a driver is mounted in its own heat sink clip on the side of the chassis near the front whilst the other two transistors and associated components are mounted on a piece of paxolin panel. Soldering points, where required, are made by using small silver plated eyelets, rivetted into the paxolin. If, due to higher power demands, the OC 30 driver is used, then this is mounted through the 3'' wide side, about 2'' in front of one of the OC 26s. Most of these details can be seen in the photographs which will be published next month.

Illustration shows the visit of Sir Lionel Hooke to the factory of Allied Industries Ltd., Auckland, towards the end of 1963.

Important Announcement

NEW ZEALAND ELECTRONICS INSTITUTE Inc.

AUCKLAND BRANCH

The Interim Committee of the newly re-established Auckland Branch of the New Zealand Electronics Institute are pleased to announce the Inaugural Meeting, to be held at 7.45 p.m. on the 17th February, 1964.

The purposes of this meeting is to bring together all persons in Auckland who are interested in electronics and in joining the Institute.

Most readers are aware of the success of branches in Christchurch, Wellington and Dunedin, thus the Committee feels certain that the Auckland Branch will very soon be sufficiently large and active enough to permit regular meetings, exhibitions, demonstrations, lectures and organised installation visits on a comparable scale.

In fact, after the business of the meeting is concluuded, Mr Phil Goldsbro of Tasman Empire Airways Ltd., will talk on some aspects of electronics in the aircraft industry. This will be followed by an informal supper.

The place in which the meeting will be held is not yet finalised since the Committee is considering two alternatives. Those interested in attending should contact the Acting-Secretary by telephone at 565-361 Auckland, or by writing c/o 8 Matipo Street, Onehunga, Auckland, S.E.5. Circular letters will then be sent advising the whereabouts of the meeting.

Peter L. Watts
Acting - Secretary

For the benefit of readers, we publish here the addresses of the Dominion and Branch Secretaries.

Dominion Secretary:
J. L. McKie,
P.O. Box 1506, Christchurch.

Christchurch Secretary:
A. Emmett,
8 Thorrington Rd., Christchurch.

Wellington Secretary:
W. S. Strong,
P.O. Box 5106, Wellington.

- enquiries concerning membership and Branch activities should be directed to these addresses.

On Our Bookshelf . . .

"Radio and Electronic Hobbies" by Judd, published by Museum Press Ltd., 1963. Size 5½" x 8¾"; 165 pp., illus., 21/- in Great Britain.

Here is a comprehensive book written in easy-to-understand language by an enthusiastic hobbyist. The author appears to be a radio amateur, a tape recordist and also interested in radio control, etc. His experience as a technical editor has undoubtedly contributed to a clear readable style. Your reviewer had to extract the review copy from the clutches of a keen 15-year-old who considers it good value to give to a schoolboy with electronic leanings.

The subjects covered are Radio Receivers, Audio-amplifiers, Transistor Circuits, High Fidelity and Stereo, Tape Recording, Electronic and Musical Instruments, Amateur Radio Transmitting, Radio Control, the Cathode Ray Tube, Aerials, Test Equipment, etc.

It is only to be expected that the breadth of coverage will have caused explanations to be shallow. There are even some explanations lacking in technical accuracy and of course quite a bit of the information on regulations, standards and frequencies is applicable to Great Britain. A trap for writers in explaining to the uninitiated is to unthinkingly insert technical jargon without previous definition. For example a reader was left wondering about the shape of a "high slope valve."

In this country a 7" spool is sold with 1800′ of L.P. tape; the 2400′ is called "double L.P." Tape is not magnetised the same way as wire. Transistors do not have their frequency response extended by a reduction in dimensions through the transistor (which would increase capacitance) but by reduction of area and a clever combination of high and low resistivity materials which also effectively reduces capacitance. Testing a transistor is not a problem to the amateur who has a simple multi-meter; a suitable tester contains 2 or 3 resistors and a push switch.

The book is good value at the price and recommended to beginners of all ages. The cautions in bold type should help the amateur experimenter to remain alive and keep out of trouble with the Post Office ! — **L.O.H.**

— • —

"Electronics," second edition by Corcoran and Price, published by Wiley and Sons, 1963. Size 6" x 9¼", 391 pp., illustrated, unpriced.

This is a college textbook rewritten to include transistors. It is fair to state that the majority of circuit analysis is based on the vacuum tube.

The book is very readable, the treatment rigorous, the examples practical and related to current techniques. The authors do not allow an equation to be a substitute for a lucid statement.

The 8 chapters cover the theory and operation of diodes; triodes and pentodes; semi-conductors; linear operation class A; junction transistor amplifiers; non-linear operation — class A and B; feedback circuits; oscillators.

Each section is well explained with the very desirable object of arousing student interest. The highlight for the reviewer was the penultimate chapter on feedback. Standard symbols are used with clear diagrams and frequent use of equivalent circuits. Each chapter concludes with a liberal set of practical problems but very few answers.

It was interesting to compare this work with a similar one from the same publisher 20 years earlier. It seems obvious that the modern textbook is designed to produce electronic engineers who can take circuit elements and design functional circuits. The older textbooks with double the number of pages covered a narrower field in greater depth — probably necessary in the training of the engineer/physicist destined to work for the manufacture of components.

This is recommended as a good first textbook for the training of electronic engineers and should not be overlooked for technical institutions. — **L.O.H.**

AWARDS FOR TECHNICIANS STUDY OVERSEAS — 1964

Last year a scheme to assist technicians to travel to the United Kingdom for advanced study and work experience was successfully launched. Six technicians received travel grants under the Commonwealth Education Scheme.

Awards will again be available this year and will cover the costs of return fares to Britain. Selected technicians are expected to remain overseas for periods of about one year, to work in approved industrial or government organisations to gain practical experience, to study as required at the appropriate technical institute, and to undertake, in special cases, fulltime short courses of training.

The awards are provided for the young career technician between the ages of 21 and 35, who is employed in industry or local or central government agencies. A "technician" for the purposes of these awards, is not a tradesman nor a scientist or professional engineer, but belongs to the intermediate group of skilled specialists. Very frequently the technician assists the engineer or scientist in his work. Fields of work in which large numbers of technicians are employed include Engineering (civil, mechanical, chemical, metallurgical, electrical — including electronics, etc.); Science (chemistry, physics, biology, agricultural science, forestry, etc.); Building; Draughting; Surveying; Town Planning; Medicine (X-ray, pathological work, nursing).

Detailed information and application forms may be obtained from the Executive Secretary, Council for Technical Education, c/- Department of Education, Private Bag, Newmarket, Auckland. Application will close on March 15, 1964.

TECHNICAL JOURNALS —Contents List

"British Communications and Electronics" — September 1963

"High resolution and fibre optic Cathode Ray Tubes," by W. A. Woodley and D. Rogers (R.R.E.).

"Static Switching Applied to Lift Controllers," by V. A. Gault (Mullard Equipment Ltd.).

ibid — October 1963

"The Royal Radar Establishment, Malvern," (a descriptive article by R.R.E. Staff).

"Research and Development in Electronics for Civil Aviation — the contribution of the Royal Aircraft Establishment, Farnborough," (a descriptive article by R.A.E. Staff).

"Electronic Components" — U.K. — July 1963

"A British Approach to Reliability," by A. H. Cooper (E.M.I. Electronics Ltd.).

"Applications of Magnetic Reed Switches."

"Some aspects of the effects of temperature on Junction Transistors," by J. Palmer (British Crystal Co. Ltd.).

ibid — August 1963

"A compact direct coupled utility (transistor) amplifier," by J. W. Halligan (Philco).

ibid — September 1963

"Masers," by K. Hoselitz (Mullard Research Laboratories).

ibid — October 1963

"Automatic monitoring of Components on life test," by I. F. M. Walker and K. J. D. Willard (British Telecommunications Research Ltd.).

"Mechanical filters for electrical oscillations," by P. Dietrich (Telefunken).

"Industrial Electronics" — U.K. — August 1963

"Cleaning by Ultrasonics," by W. G. A. McCormick (Grffii.n and George Ltd., formerly Dawe Instruments Ltd.).

"Stabilised High Voltage Supplies," by J. P. Holland (M-O Valve Co. Ltd.).

"Journal of the Institution of Electrical Engineers" — U.K. — July 1963

"Closed circuit television for the inspection of fast-moving surfaces." by G. Syke and C. Burns (British Iron and Steel Research Association).

ibid — September 1963

"Patents and the Engineer," by I. J. S. Crawshaw (British Electronic Industries Ltd.).

"Proceedings of the Institution of Electrical Engineers" — U.K. — July 1963

This issue contains seven articles dealing with various aspects of the Transatlantic Telephone Cable (CANTAT). A series of articles well worth study — Ed.

ibid — August 1963

"Modern trends in h.f. transmitter design," by L. J. Heaton Armstrong and B. S. Jackson (S.T.C.).

"Developments in long distance h.f. point-to-point communications," by J. L. Creighton, P. R. Hutton-Penman and W. M. Davies (British P.O. Engineering Dept.).

ibid — September 1963

"H.F. Maritime mobile services," by R. M. Billington and G. H. M. Gleadle (British P.O.), worth study — Ed.

OVERSEAS VISIT BY W. L. HARRISON

— Director of Engineering for the N.Z.B.C.

Recently returned from two visits overseas, Mr. W. L. Harrison, Director of Engineering for the New Zealand Broadcasting Corporation, was interviewed on his return to Wellington by "Radio and Electrical Review." With the Director-General of the N.Z.B.C., Mr G. H. Stringer, Mr Harrison represented New Zealand broadcasting at the Commonwealth Broadcasting Conference in Montreal, Canada. These conferences are held three-yearly, to discuss administrative, technical and programme matters of common interest. The next conference will be in Nigeria in 1966.

After Montreal, Mr Stringer and Mr Harrison visited London and several European countries to get informaton on the latest developments in television and broadcasting in the programme and engineering fields. In the United Kingdom, Mr Harrison met manufacturers' representatives and officials of the British Broadcasting Corporation and Independent Television Association; and in Europe, many engineering executives.

"This is a period of consolidation for television in Europe," Mr Harrison commented. Most organisations had begun, like New Zealand, with low budgets, and were now building extensive permanent studios. Television is expanding, with the number of viewers' licences increasing rapidly.

While in London, he attended some meetings of the study group of the European Broadcasting Union, formed to advise the Union which colour television standard to choose. The B.B.C., having been authorised by the British Government to begin colour transmissions, has adapted the N.T.S.C. system to 625 lines. Germany has developed the PAL system, and France the SECAM. From these the E.B.U. has to choose one standard for the whole of Europe so that Eurovision will use only one system. Mr Harrison had the opportunity of seeing several demonstrations of the three systems, side by side, which were specially arranged in London by the B.B.C., I.T.A. and E.B.U.

It is likely that New Zealand would follow the E.B.U. choice, Mr Harrison said, though there are not plans for colour television for New Zealand in the immediate future. He emphasised that any system chosen for New Zealand will be compatible, so that viewers with "black and white" receivers could still receive the programme even if transmitted in colour.

Mr Harrison's other visit was to Seoul, in Korea, with Mr Stringer, to represent the N.Z.B.C. at the Fifth Asian Broadcasting Conference.

The Conference decided to form a permanent Asian Broadcasting Union, of which New Zealand would be a member. The next conference will be in Sydney towards the end of this year.

"Radio and Electronic Engineer" — (J. Brit. I.R.E.) — U.!K. — August 1963

"A frequency meter with continuous digital presentation," by P. Wood (Plessey Ltd.).

"The use of Projects in the Practical Training of Engineers," by L. P. Grice and others.

ibid — September 1963

"The Condenser Microphone and some of its uses in Laboratory Investigations," by P. V. Bruel and W. J. Parker (Bruel and Kjoer, Copenhagen).

"Wireless World" — U.K. — November 1963

"Wireless World—Audio Signal Generator."

"New Low noise Transistor Circuit for Electrostatic Microphones," by P. J. Baxandall, B.Sc. (Eng.).

"Why Coaxial Cables?," by Cathode Ray.

"Short Wave Magazine" — U.K. — November 1963

"Modern S.S.B. Transmitter for 3 Bands—Part 2," by J. D. Heys, G3BDQ.

"Receiving Modulation Meter—a Circuit for Direct Reading of Modulation Depth."

"For the Beginner—Discussing Amplifiers."

"This Decibel Business—What Is It and How to Use It," by J. B. Tuke, GM3BST.

"A Simple Wide Range Modulated Test Oscillator."

"Radiotronics" — Australia — November 1963

"Crystal Pickup Cartridges," by B. J. Simpson.

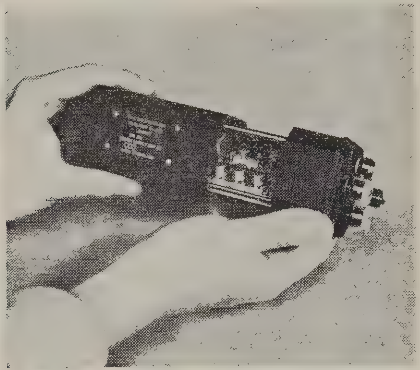
"Mobile 50 Watt Transmitter," by M. R. Adams, WA2ELL, and P. B. Boivin, K2SKK.

NEW PRODUCTS: LATEST RELEASES IN ELECTRICAL AND ELECTRONIC EQUIPMENT

This section of our paper is reserved for the introduction of new products and space preference is given to our regular advertisers. For further particulars, contact Advertising Manager, "R. & E.," Box 1365, Auckland.

MICRO - MINIATURE MARKER BEACON RECEIVER

One of the more important exhibits on the Marconi stand at the recent R. & D. Symposium at R.R.E., Malvern, was an experimental 75 Mc/s Marker Beacon Receiver. This project was an essay into the techniques of micro-miniature circuit construction, and it represents the first completely practical application of these techniques, in that the receiver conforms fully with all current operational requirements, and meets the specification laid down in the R.T.C.A. Manual 87-54/DO-57.



The use of micro-miniature circuitry has made it possible to accommodate the entire receiver with its displays in a single unit, with less than a quarter of the size and weight of the current Sixty Series Marker Receiver, but the most important feature of the project is the increase in reliability achieved by the use of these techniques. Calculations based upon the failure rates of individual components predict that the complete unit will have an eventual "mean time between failure" of the order of 30,500 hours.

The receiver is only 5″ long, and with the indicator lamps and controls mounted as on a normal marker beacon indicator unit. The three coloured indicator lamps are mounted on the front panel together with a three position switch which controls the receiver sensitivity. The lamps are all of the "press-to-test" variety and are designed to give good visibility in both day and night conditions. The circuitry is contained on two printed boards supported by four pillars, rigidly mounted on a backplate. The printed connection are gold plated copper, giving extremely low contact resistance and improved resistance to corrosion.

The complete unit is design to operate from an aircraft 28v d.c. supply, power for the transistorised circuits being derived from a series regulator which is in turn controlled by a micro-circuit control system.

The receiver, which is being developed to operate through the entire climatic range appropriate to aircraft electronic equipment, is expected to provide valuable operational information on this type of circuit construction, which seems likely to play a major role in the next generation of air radio equipment.

THE "X" AND "Y" ARE INTERCHANGEABLE IN SOLARTRON'S NEW DUAL TRACE MODULAR OSCILLOSCOPE TYPE CD.1183

The new dual trace modular Oscilloscope, Type CD.1183, designed and manufactured by the Solartron Electronic Group, Ltd., Farnborough, Hampshire, is the only one of its type that has made use of the principle of modular construction so that the "X" and "Y" self-contained modules may be interchanged speedily and easily when required.

The CD.1183 has a wide range of applications, with Solartron pre-amplifier plug-in units. The instrument may be used for most general laboratory work, including medium-fast investigation, servo and strain gauge work under stringent requirements, "X", "Y" plotting, electro-medical work, the design and servicing of computers, data logging and accounting machines and for television engineering.

The main unit contains a high resolution cathode-ray tube, a multi-range 1 kc per second calibrator, two main vertical deflection amplifiers (Y_1 and Y_2), one main horizontal deflection amplifier (X), and all power supplies.

The gain of the X and Y main amplifiers is equalised to permit any vertical, plug-in pre-amplifier to be used for horizontal deflection.

The following plug-in units are currently available:

(1) Wide-band pre-amplifier CX 1270 (DC-10 Mc per second).
(2) High gain DC differential pre-amplifier CX 1271 (100 microvolts per cm.).
(3) Time base generator CX 1272 (0·5 microsec per cm — 12 second per cm.).

Many desirable features normally associated with higher priced instruments have been incorporated, including an accurate 1 kc per second-multirange calibrator for checking the gain of all plug-in amplifiers and the time calibration of time-base; a bright, high resolution display and single sweep time-base mode for high speed trace photography; fully stabilised H.T., E.H.T. and heater supplies enable a D.C. sensitivity of 100 microvolts per c.m. to be obtained with minimum DC drift.

The Solartron Electronic Group Ltd. is represented in New Zealand by E. C. Gough Ltd.

PHILIPS DEVELOP NEW TV TUBE

At the laboratory of N. V. Philips Gloeilampenfabrieken in Holland, a new type of television camera tube has been developed, which has been given the name Plumbicon.

This tube, which is highly suited to black and white television and, in addition, outstandingly suitable for filming coloured television pictures, promises to play an important role in the possible introduction of colour television in the future. The Plumbicon tube is the product of years of development work. It is simple and compact, easy to operate and characterised by great sensitivity as well as by a very low response time which is, furthermore, independent of the level of illumination.

Its great sensitivity makes the tube equivalent in this respect to the most sensitive pick-up tubes at present in use in television broadcasting, viz., orthicons. From the point of view of colour television the tube is even several times more sensitive.

RAPID SYNCHRONISING TIMES BY AUTOMATIC UNIT

Synchronising times of between 10 and 30 seconds are claimed for a new unit suitable for the automatic paralleling of alternators in power stations, marine installation and mobile power supplies. The manufacturers further state, the unit has been designed to be relatively insensitive to vibration, humidity or high ambient temperature. Interlocking circuitry is arranged to give maximum fail-safe protection.

POCKET-SIZED INSTRUMENT MEASURES NOISE

A pocket-size sound level indicator for making spot checks on noise has been developed by a British firm. The indicator, which is fully transistorised, measures 6 x 3 x 2¼ inches and weighs about 14 ounces complete with nine-volt dry battery, which gives about 70 hours of operation. Its range is from 40 decibels (a low whisper) to 120 decibels (a jet aircraft at take-off).

LIGHT-WEIGHT RADIO TELEPHONE

A fully transistorised, light-weight radio-telephone for reliable ship-to-shore contact has been developed by a British firm. Primarily designed for use on smaller craft, where space and power is limited, it is also suitable for operation on larger vessels. Providing full reception over its navigational/long wave, medium wave and marine R/T bands, it is highly sensitive and gives extremely good discrimination against unwanted signals.

NEW AWA RADIO PLAYS

The New Zealand Broadcasting Corporation has purchased two of AWA's most recent radio productions: "The Avenger" and "Requiem for Paul Jason."

Both serials are of a dramatic nature and have been developed around absorbing stories. They are each composed of 104 x 15 minute episodes. The series are intended for playing over New Zealand commercial stations.

Overseas Notebook . . .

AUSTRALIAN - MADE TELEVISION TRANSMITTERS SHIPPED TO SINGAPORE

First locally-made television transmitters to be exported from Australia left Sydney for Singapore recently. The transmitters and ancillary equipment were shipped in the Royal Interocean Line vessel, "Houtman." Manufactured at the Ashfield Works of Amalgamated Wireless (Australasia) Ltd., the transmitters were for Television Singapore. AWA was awarded the contract in open competition with other world manufacturers. The order followed the decision of the Broadcasting Division of the Singapore Government's Ministry of Culture to extend Singapore's television facilities.

A NEW ENGINEERING SERVICE FOR INDUSTRY

A clearing house for manufacturers who want things made and firms who have the engineering capacity to make them, has been set up in London. It operates for firms within Britain and on a two-way basis between Britain and overseas.

Foreign patent agents, Chambers of Commerce or individual companies, can be helped to produce new products under licence in Britain and British manufacturers can be helped in respect of production overseas. New products already handled on this basis, range from large equipment for handling concrete to a special camera for underground inspection work. No product is too large or too small provided it involves engineering techniques. The organisation has already built up a massive index of basic information about British engineering facilities which is held in a mechanical punched card system. The system, operated on two data channels, covers (1) the permanent details of the capacity of member firms in terms of machines, processes, handling capacity, inspection, quality of workmanship and delivery record and (2) current details of capacity available, work to be placed, materials, techniques and the like. This information about firms is assembled by properly qualified engineers competent for each industry involved and is far more detailed than anything which can normally be carried in trade directories. Additionally, a materials location service operated by the Exchange covers all grades and qualities of rare and precious metals which in some cases are surplus to requirements and in short supply in others.

Machine time capacities already registered cover more than 3 million man hours a week. The register covers firms in all branches of engineering who are capable of undertaking new and difficult work. Fees charged to member firms represent a fraction of 1% turnover and a once-only charge of up to 1½% is made to each sub-contractor on work introduced through the Exchange.

COMPUTER SYSTEM KEEPS AIRCRAFT ON COURSE

A small computer system which can keep a long-range aircraft on course without aid from ground stations was introduced recently in London. A pilot or navigator can feed in the distance of the first leg of a route and the compass bearing before take-off. Once in the air, a small dial shows the ground miles as they are covered and another dial shows a figure in miles how much the plane has "drifted" off course. With the system working to an automatic pilot, the plane is automatically put on to the second leg of the route at the correct position.

The last "manoeuvre" is the result of the course bearing and the distance of the second leg being fed into the computer while flying along the first. Consequently each leg of the route is ready in the computer long before the point of turning into a new direction. It is claimed that the computer can be of major importance when flying over areas where there are few ground stations to give a position check to pilot or navigator, such as the Atlantic, Pacific or some Middle East areas.

SECONDARY RADAR

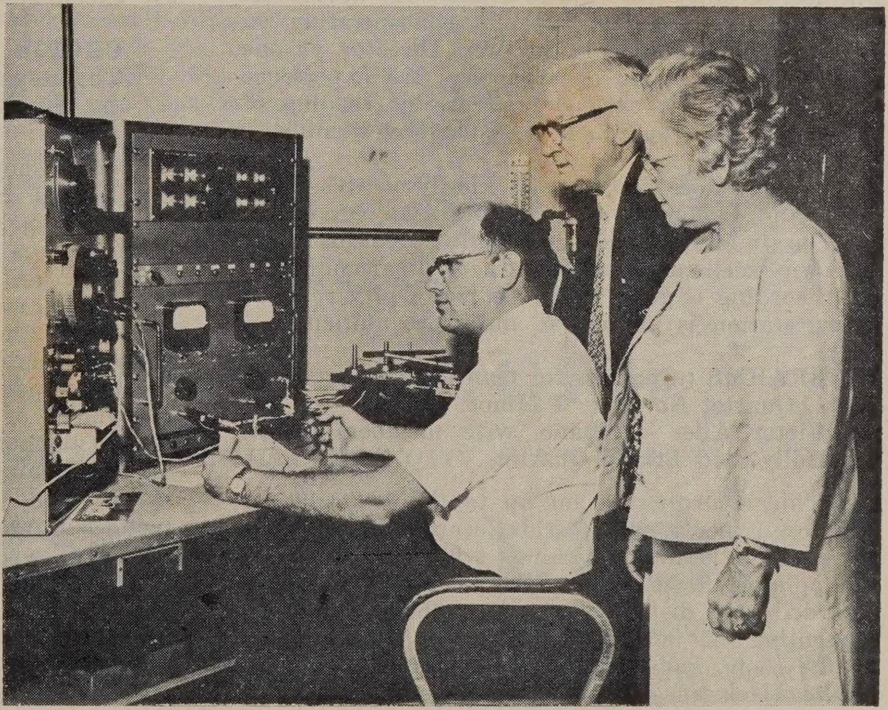
A new Anglo-French technical consortium came into being recently with the signing of a formal agreement between the Marconi Company and Compagnie Francaise Thomson-Houston to produce jointly a completely new Secondary Surveillance Radar Ground Interrogator and Decoding System to be known as SECAR. Technical discussions between the two companies have been in progress since the end of 1962 and the main units of the system have now reached an early stage of production.

This equipment, which is completely transistorised, except for the high power output stages, employs a number of new techniques. All civil and military codes of operation, and all present and future requirements of ICAO and Eurocontrol will be accommodated by this system.

Dean of British Hi-Fi Visits American Manufacturers

Percy Wilson, technical editor of "Gramaphone" magazine and Britain's foremost authority on high-fidelity, combined a recent personal visit to the U.S.A. with an inspection tour of several high fidelity manufacturers whose products are marketed overseas.

Wilson is shown here looking over the shoulder of Roger Anderson, Manager, Research and Development Section of Shure Brothers, Inc., Evanston, Illinois, as Anderson runs a tracking capability test on one of Shure's Stereo Dynetic high fidelity cartridges.



Record Reviews

by RAY WILSON
Mus. B.

CHOPIN : Mazurkas.
Malcuzynski — Pianoforte.

Chopin's own personal nationalism is firmly imprinted on nearly all his piano works; but there are none more characteristically national than his Mazurkas. Originating in the 16th century as songs accompanied by dancing, the form developed in succeeding centuries to become the traditional, robust dance of the Polish people.

The composer's early Mazurkas (not represented on this disc) clearly show the latent talent, which a little later forced Chopin to shy away from merely copying the style of his contemporaries.

I cannot imagine better performances than appear on this disc. I hardly need to point out, that Malcuzynski is a Chopin pianist without peer. The controlled passion, clear lyrical tone and satisfying sense of form united with a sensitive touch and an exemplary choice of tempi, produce with very fine sound engineering a recording which I will treasure greatly.

* * *

DVORAK : Symphony No. 5 in E Minor, Op. 95, "Carnaval Overture," Op. 92.
Philharmonia Orchestra conducted by Wolfgang Sawallisch.

My catalogue shows twenty-four versions of this wonderful Symphony (listed, of course, under its correct number, 9). This Sawallisch version, first recorded early 1960, is a good workmanlike showing. One looks in vain for the excitement present in the old Toscanini, or the warm lyricism of Karajan. Sawallisch is a young Viennese conductor, who has recently made quite a name for himself at Byreuth, and is at the moment concentrating on opera conducting. He is, in fact, Director of one of the larger German opera houses. His experience in this field quite naturally affects his reading of the classic, with consequent occasional over-emphasis and the like.

Dvorak does not respond kindly to this treatment, and I would prefer the Karajan version or the Dorati and the Concertgebouw. Sawallisch obtains an excellent sound from the Philharmonia and the recording is good, and it is just a pity that his interpretation is not easier and more authentic.

* * *

BRAHMS : Quartets for piano and strings. Vol. 1. Quartet No. 1 in G Minor. Op. 25.
Victor Aller — Piano, with members of the Hollywood String Quartet.

This recording is not up to the standard we can now expect from World Records. I am afraid there are a number of things which force one to this opinion. Firstly, the piano seems to have been recorded some distance away from the strings. Consequently, one imagines the strings to have been in one room, and the piano in another, with consequent lack of ensemble and cohesion. Secondly, the tone of both piano and strings is wiry and unnatural — I had to wind down the treble until I was admitting only those frequencies below about 6,000 c.p.s. Thirdly, the interpretation is just not satisfactory. The piano soloist seem a rather intensive player, and the members of the Hollywood Quartet follow his style. One is left with a lack of phrasing, rhythmic inaccuracies and a general feeling of dissatisfaction.

To those interested in this fine chamber work, I would recommend the Goldberg, Primrose, Gaudin, Babin version, obtainable on RCA - Victor.

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BEETHOVEN : The String Quartets Volume 1 No. 1 in F Major, op. 18, No. 2 in G Major, op. 18.
Hungarian String Quartet.

This recording is quite an auspicious one, as the first of a series of Beethoven String Quartets. The Record Society can publish collections like these, knowing that the issue now and then, will be eagerly looked for in their catalogues. It is to be hoped that their policy of issuing complete sets such as this will continue.

With regard to the recording and performance of these early Beethoven Quartets, the Hungarian Quartet presents us with quite a laudable effort. Am I correct in imagining that this Quartet, which has been in existence for over twenty-five years with the same personnel is becoming just a shade slap-dash? For instance, the intonation of the leader is not impeccable, and there is some questionable ensemble here and there. However, the style is fine, the tone is warm and vibrant and I imagine that Beethoven would have been pleased to hear performances of such a standard at Forster's musical house parties.

The recording is a little wiry, but the notes are excellent, and presentation first class.

* * *

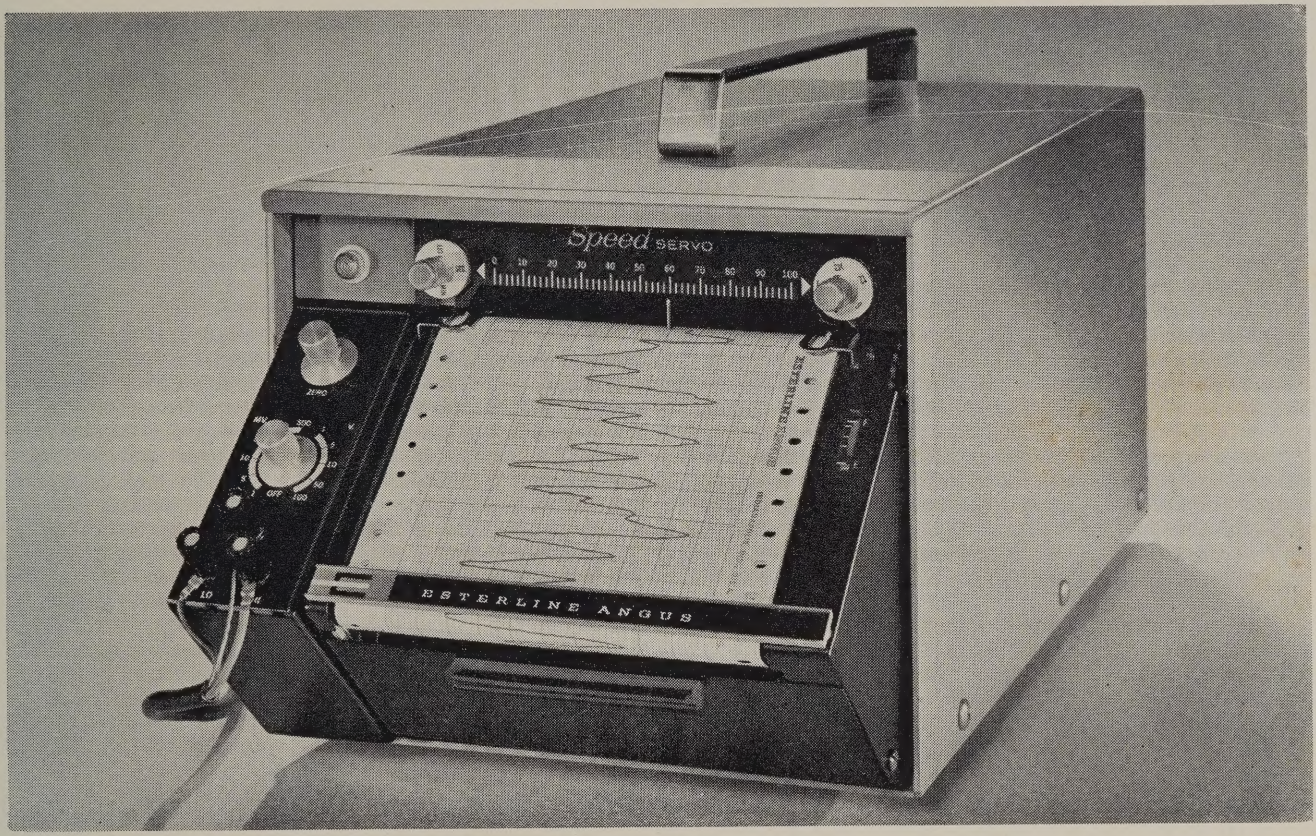
CHOPIN : Piano Concertos No. 1 and 2.
The Royal Philharmonic Orchestra, conducted by Sir Eugene Goosens, with Abbey Simon, piano.

The Chopin concertos are surprisingly well represented in Record Catalogues. I have never derived much pleasure from them myself, but have always thought that Chopin's elementary orchestration was responsible for my lack of interest. However, whilst reviewing this disc, I dug out scores and determinedly tried to get to know them better. I am afraid Chopin's pianism in the orchestra part is an insuperable obstacle for my enjoyment of these works as a whole. There are beautiful spots, for instance, the slow movement of the E minor, but for my money, both of these works would have been more effective written for piano solo alone.

The performance is adequate, with excellent support from Goosens and the Philharmonia. Delicate phrasing from wood-wind and horns add considerably to the rather uninteresting orchestration, and the recorded sound is spacious and clean.

(Records by World Record Club)

Printed for the publishers, The Magazine Press Ltd., Lumley House, 10 High St., Auckland, C.1, by Farrell Printing Ltd., 69 Carr Rd., Mt. Roskill, Auckland.



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